EXPLORATORY SURVEY

OF PART OF THE

LEWES, TAT-ON-DUC, PORCUPINE, BELL, TROUT PEEL

AND

MACKENZIE RIVERS

BY

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EXPLORATORY SURVEY OF PART OF THE LEWES, TAT-ON-DUC, PORCUPINE, BELL, TROUT, PEEL, AND MACKENZIE RIVERS.

To the Honorable
The Minister of the Interior,
Ottawa.

OTTAWA, 16th July, 1889.

SIR,—I have the honor to submit the following report of my operations on the Lewes or Yukon River, in the season of 1887 (of which a preliminary sketch was published in the Annual Departmental Report for that year), and on the Tat-on-Duc, Porcupine, Bell, Trout, Peel and Mackenzie Rivers during the season of 1888.

I left Ottawa on the 20th of April, 1887, for Toronto, where I remained for two days doing some preparatory work in the magnetic observatory having relation to the magnetic observations which I intended to make during the progress of my expedition, and also supervising some changes and repairs of instruments, the chief object of which was to lessen their weight, and thus facilitate progress.

I had to stop one day in Winnipeg, to obtain an astronomical transit (F. O. 2). On the evening of the 2nd May I reached Victoria, B.C., where I at once set about making the necessary preparations to start by the boat, which was advertised to leave on the 9th. The vessel did not arrive, however, until the 12th. I then found that she was much overloaded, and it was with some difficulty that I got Capt. Hunter to consent to take my outfit which weighed about six tons, and, under the circumstances, it was a real act of kindness for him to do so.

Owing to the heavy load, we made slow progress, and it was not until the 18th of May that we reached Fort Wrangell, at the mouth of the Stikine River. Here I parted from Dr. Dawson, whom I arranged to meet at the confluence of the Pelly, and Lewes or Yukon River about the 20th of July following. We arrived at Juneau City on the evening of the 19th, remaining there and at Douglass Island until the evening of the 20th. At Douglass Island I had an opportunity of visiting the celebrated Treadwell gold mine and reduction works, containing one hundred and twenty stamps, which have since been doubled in number. The output of this mine, with the smaller number of stamps, was generally estimated at about $70,000 per month, but no one seemed to know the exact amount.

As the boat was now much behind time she went direct to Sitka, instead of Chilkoot, as usual; thence in succession to Sitka, Killisnoo, Chilcat and Chilkoot, where I landed on the morning of the 24th of May, and where my work began.

The first news I received on landing was that there was trouble in the interior, on the Lewes River, in the vicinity where I intended to go. A miner, who had recently arrived from the interior, stated that there had been a fight between the Indians and the miners at the mouth of Stewart River. The result of the affair, he alleged, was that four Indians and two white men had been killed, and that the Indians had come up the river as far as the cañon to lie in wait for any white men who might be going into the country. I did not have an opportunity of questioning him, as he had gone to Juneau City the day before I arrived. The rumor seemed to me somewhat improbable; but true or false, it was an unpleasant one to hear, and the only way to verify it was to go and see whether the Indians were hostile or not. Happily the whole story proved to be untrue, as I subsequently learned from the miners in the interior that he had difficulties with them, in consequence of which he was ordered in mid-winter to leave the region, which the miners consider equivalent to a sentence of death. Strange to say, he succeeded in getting out alive, making a distance of upwards of 500 miles of the most dangerous and difficult travelling. He

started in the month of February, I think, and reached the coast in the month of May. It is reported that on his way out he had more trouble with an Indian whom he hired to accompany him. Another miner named Williams started from Stewart River for the coast in the month of December, carrying a message from Harper, McQuestion & Co., and mail from the miners. This man had the advantage at intervals of the assistance of the miners, a few of whom were scattered along the river in the vicinity of the Teslin-too (the Newberry of Schwatka). At the summit of the coast range he was detained by a snow storm for three days, and the hardships he suffered brought on pneumonia, from the effects of which he died.

It is said by those familiar with the locality that the storms which rage in the upper altitudes of the coast range during the greater part of the time, from October to March, are terrific. A man caught in one of them runs the risk of losing his life, unless he car reach shelter in a short time. During the summer there is nearly always a wind blowing from the sea, up Chatham Strait and Lynn Channel, which lie in almost a straight line with each other, and at the head of Lynn Channel are Chilkat and Chilkoot inlets. The distance from the coast down these channels to the open sea is about 380 miles. The mountains on each side of the water confine the currents of air, and deflect inclined currents in the direction of the axis of the channel, so that there is nearly always a strong wind blowing up the channel. Coming from the sea, this wind is heavily charged with moisture, which is precipitated when the air current strikes the mountains, and the fall of rain ands now is consequently very heavy.

In Chilkat Inlet there is not much shelter from the south wind, which renders it unsafe for ships calling there. Capt. Hunter told me he would rather visit any other part of the coast than Chilkat.

After landing at Chilkoot the weather continued very wet for three days, so that I could not do anything in the way of commencing the survey, and during the delay myself and party were employed in making preparations for carrying the instruments, provisions and other baggage up to the head of Taiya Inlet, a distance of 20½ miles. This was accomplished by securing the services of two boats belonging to a trader, which were towed to the head of the Taiya Inlet by the United States gunboat, "Pinta," to the commander of which (Capt. Newell) I owe a debt of gratitude for his very obliging and attentive treatment of myself and party.

Section I.

Exploratory Survey *from the Head of Taiya Inlet, through Taiya Pass, and down the Pelly-Yukon River to the International Boundary between Alaska and the North-West Territories of Canada.*

On the 30th of May I commenced the survey by connecting Pyramid Island in Chilkat Inlet with Chilkoot Inlet at Haines mission. At this point a Protestant mission was established some years ago; but it is now abandoned, owing, as I was informed, to the very unpleasant conduct of the Chilkoot Indians. I could not learn that they had committed any overt act of hostility, but it appears the missionary tried to relieve the sufferings of a sick Indian child. Unfortunately, the child died, and the father attributed the death to the missionary, and from that time acted in so suspicious a manner towards the children of the latter that he considered it unsafe to remain in the vicinity, and moved into Juneau City.

The teacher of the United States Government school for Indians at Haines mission, Col. Ripinsky, told me he had got into trouble in the same way. A sick Indian to whom he administered medicine at first became much worse, in consequence, apparently, of the treatment, and during this time the patient's relatives walked about in an exciting manner, manifesting very unpleasant signs of hostility. Fortunately the man finally recovered, but Col. Ripinsky has no doubt that his life would not have been safe had he died.

The latitude and longitude of Pyramid Island were determined in 1869 by a United States Coast Survey party, who were sent out to observe the eclipse of the sun in the month of August of that year. The position then determined is given in the

"Alaska Coast Pilot" as latitude 59° 11′ 43″ ·0, longitude 135° 27′ 04″ ·5. The longitude was determined by chronometers, thirteen having been used by the expedition. What point of the island was fixed I could not ascertain, so I took the centre. This island is pyramidal in form, as seen from the south-west or north-east, and about 500 yards long by 200 wide. It is composed of sand and clay, and rises about 80 feet above high tide, being evidently the result of glacial action. At low tide there is very little water on the north side of the island, and it is only a question of a few years until it will cease to be an island altogether, owing to the constant accumulation of drift brought down by the streams flowing into the inlet.

To carry the survey from the island across to Chilkoot Inlet I had to get up on the mountains north of Haines mission, and from there could see both inlets. Owing to the bad weather I could get no observation for azimuth, and had to produce the survey from Pyramid Island to Taiya Inlet by reading the angles of deflection between the courses. At Taiya Inlet I got my first observation, and deduced the azimuth of my courses up that point. Taiya Inlet has evidently been the valley of a glacier; its sides are steep and smooth from glacial action; and this, with the wind almost constantly blowing landward, renders getting upon the shore difficult. Some long sights were therefore necessary. The survey was made up to the head of the inlet on the 2nd of June. Preparations were then commenced for taking the supplies and instruments over the coast range of mountains to the head of Lake Lyndeman on the Lewes River. Commander Newell kindly aided me in making arrangements with the Indians, and did all he could to induce them to be reasonable in their demands. This, however, neither he nor any one else could accomplish. They refused to carry to the lake for less than $20 per hundred pounds, and as they had learned that the expedition was an English one, the second chief of the Chilkoot Indians recalled some memories of an old quarrel which the tribe had with the English many years ago, in which an uncle of his was killed, and he thought we should pay for the loss of his uncle by being charged an exorbitant price for our packing, of which he had the sole control. Commander Newell told him I had a permit from the Great Father at Washington to pass through his country safely, that he would see that I did so, and if the Indians interfered with me they would be punished for doing so. After much talk they consented to carry our stuff to the summit of the mountain for $10 per hundred pounds. This is about two-thirds of the whole distance, includes all the climbing and all the woods, and is by far the most difficult part of the way.

On the 6th of June 120 Indians, men, women, and children, started for the summit. I sent two of my party with them to see the goods delivered at the place agreed upon. Each carrier when given a pack also got a ticket, on which was inscribed the contents of the pack, its weight, and the amount the individual was to get for carrying it. They were made to understand that they had to produce these tickets on delivering their packs, but were not told for what reason. As each pack was delivered one of my men receipted the ticket and returned it. The Indians did not seem to understand the import of this; a few of them pretended to have lost their tickets; and as they could not get paid without them, my assistant, who had duplicates of every ticket, furnished them with receipted copies, after examining their packs.

While they were packing to the summit I was producing the survey, and I met them on their return at the foot of the cañon, about eight miles from the coast, where I paid them. They came to the camp in the early morning before I was up, and for about two hours there was quite a hubbub. When paying them I tried to get their names, but very few of them would give any Indian name, nearly all, after a little reflection, giving some common English name. My list contained little else than Jack, Tom, Joe, Charley, &c., some of which were duplicated three and four times. I then found why some of them had pretended to lose their tickets at the summit. Three or four who had thus acted presented themselves twice for payment, producing first the receipted ticket, afterwards the one they claimed to have lost, demanding pay for both. They were much taken aback when they found that their duplicity had been discovered.

These Indians are perfectly heartless. They will not render even the smallest aid to each other without payment; and if not to each other, much less to a white man. I got one them, whom I had previously assisted with his pack, to take me and two of my party over a small creek in his canoe. After putting us across he asked for money, and I gave him half a dollar. Another man stepped up and demanded pay, stating that the canoe was his. To see what the result would be, I gave to him the same amount as to the first. Immediately there were three or four more claimants for the canoe. I dismissed them with a blessing, and made up my mind that I would wade the next creek.

While paying them I was a little apprehensive of trouble, for they insisted on crowding into my tent, and for myself and the four men who were with me to have attempted to eject them would have been to invite trouble. I am strongly of the opinion that these Indians would have been much more difficult to deal with if they had not known that Commander Newell remained in the inlet to see that I got through without accident.

While making the survey from the head of tide water I took the azimuths and altitudes of several of the highest peaks around the head of the inlet, in order to locate them, and obtain an idea of the general height of the peaks in the coast range. As it does not appear to have been done before, I have taken the opportunity of naming all the peaks, the positions of which I fixed in the above way. The names and altitudes appear on my map.

While going up from the head of canoe navigation on the Taiya River I took the angles of elevation of each station from the preceding one. I would have done this from tide water up, but found many of the courses so short and with so little increase in height that with the instrument I had it was inappreciable. From these angles I have computed the height of the summit of the Taiya Pass, above the head of canoe navigation, as it appeared to me in June, 1887, and find it to be 3,378 feet. What depth of snow there was I cannot say. The head of canoe navigation I estimate at about 120 feet above tide water. Dr. Dawson gives it as 124 feet.

While going over the range the first time I made frequent readings of the mercurial barometer, and left the instrument at the summit for several days, taking readings of it as often as possible. At the same time I took corresponding readings of my aneroid. These readings will be found in the appendix to this report, and from them it will be seen that this particular aneroid is almost as reliable as the mercurial barometer as far as the altitudes reached would show.

I determined the descent from the summit to Lake Lyndeman by carrying the aneroid from the lake to the summit and back again, the interval of time from start to return being about eight hours. Taking the mean of the readings at the lake, start and return, and the single reading at the summit, the height of the summit above the lake was found to be 1,237 feet. While making the survey from the summit down to the lake I took the angles of depression of each station from the preceding one, and from these angles I deduced the difference of height, which I found to be 1,354 feet, or 114 feet more than that found by the aneroid. This is quite a large difference; but when we consider the altitude of the place, the sudden changes of temperature, and the atmospheric conditions, it is not more than one might expect.

While at Juneau City I heard reports of a low pass from the head of Chilkoot Inlet to the head waters of Lewes River. During the time I was at the head of Taiya Inlet I made inquiries regarding it, and found that there was such a pass, but could learn nothing definite about it from either whites or Indians. As Capt. Moore, who accompanied me, was very anxious to go through it, and as the reports of the Taiya Pass indicated that no waggon road or railroad could ever be built through it, while the new pass appeared, from what little knowledge I could get of it, to be much lower and possibly feasible for a waggon road, I determined to send the captain by that way, if I could get an Indian to accompany him. This, I found, would be difficult to do. None of the Chilkoots appeared to know anything of the pass, and I concluded that they wished to keep its existence and condition a secret. The Tagish, or Stick Indians, as the interior Indians are locally called, are afraid to do anything in oppo-

sition to the wishes of the Chilkoots; so it was difficult to get any of them to join Capt. Moore; but after much talk and encouragement from the whites around, one of them named "Jim" was induced to go. He had been through this pass before, and proved reliable and useful. The information obtained from Capt. Moore's exploration I have incorporated in my plan of the survey from Taiya Inlet, but it is not as complete as I would have liked. I have named this pass "White Pass," in honor of the late Hon. Thos. White, Minister of the Interior, under whose authority the expedition was organized. Commencing at Taiya Inlet, about two miles south of its north end, it follows up the valley of the Shkagway River to its source, and thence down the valley of another river which Capt. Moore reported to empty into the Takone or Windy Arm of Bove Lake (Schwatka). Dr. Dawson says this stream empties into Tako Lake, and in that event Capt. Moore is mistaken. Capt. Moore did not go all the way through to the lake, but assumed from reports he heard from the miners and others that the stream flowed into Windy Arm, and this also was the idea of the Indian "Jim," from what I could gather from his remarks in broken English and Chinook. Capt. Moore estimates the distance from tide water to the summit at about 18 miles, and from the summit to the lake at about 22 to 23 miles. He reports the pass as thickly timbered all the way through.

The timber line on the south side of the Taiya Pass, as determined by barometer readings, is about 2,300 feet above the sea, while on the north side it is about 1,000 feet below the summit. This large difference is due, I think, to the different conditions in the two places. On the south side the valley is narrow and deep, and the sun cannot produce its full effect. The snow also is much deeper there, owing to the quantity which drifts in from the surrounding mountains. On the north side the surface is sloping, and more exposed to the sun's rays. On the south side the timber is of the class peculiar to the coast, and on the north that peculiar to the interior. The latter would grow at a greater altitude than the coast timber. It is possible that the summit of White Pass is not higher than the timber line on the north of the Taiya Pass, or about 2,500 feet above tide water, and it is possibly even lower than this, as the timber in a valley such as the White Pass would hardly live at the same altitude as on the open slope on the north side.

Capt. Moore has had considerable experience in building roads in mountainous countries. He considers that this would be an easy route for a waggon road compared with some roads he has seen in British Columbia. Assuming his distances to be correct, and the height of the pass to be probably about correctly indicated, the grades would not be very steep, and a railroad could easily be carried through if necessary.

After completing the survey down to the lake I set about getting my baggage down too. Of all the Indians who came to the summit with packs, only four or five could be induced to remain and pack down to the lake, although I was paying them at the rate of $4 per hundred pounds. After one trip down only two men remained, and they only in hopes of stealing something. One of them appropriated a pair of boots, and was much surprised to find that he had to pay for them on being settled with. I could not blame them much for not caring to work, as the weather was very disagreeable; it rained or snowed almost continuously. After the Indians left I tried to get down the stuff with the aid of my own men, but it was slavish and unhealthy labor, and after the first trip one of them was laid-up with what appeared to be inflammatory rheumatism. The first time the party crossed the sun was shining brightly, and this brought on snow blindness, the pain of which only those who have suffered from this complaint can realize. I had two sleds with me which were made in Juneau City specially for the work of getting over the mountains and down the lakes on the ice. With these I succeeded in bringing about a ton and a-half to the lakes, but I found that the time it would take to get all down in this way would seriously interfere with the programme arranged with Dr. Dawson, to say nothing of the suffering of the men and myself, and the liability to sickness which protracted physical exertion under such uncomfortable conditions and continued suffering from snow blindness expose us to I had with me a white man who lived at the head of the inlet with a Tagish Indian woman. This man had a good deal of influence with the

Tagish tribe, of whom the greater number were then in the neighborhood where he resided, trying to get some odd jobs of work, and I sent him to the head of the inlet to try and induce the Tagish Indians to undertake the transportation, offering them $5 per hundred pounds. In the meantime Capt. Moore and the Indian "Jim" had rejoined me. I had their assistance for a day or two, and "Jim's" presence aided indirectly in inducing the Indians to come to my relief.

The Tagish are little more than slaves to the more powerful coast tribes, and are in constant dread of offending them in any way. One of the privileges which the coast tribes claim is the exclusive right to all work on the coast or in its vicinity, and the Tagish are afraid to dispute this claim. When my white man asked the Tagish to come over and pack they objected on the grounds mentioned. After considerable ridicule of their cowardice, and explanation of the fact that they had the exclusive right to all work in their own country, the country on the north side of the coast range being admitted by the coast Indians to belong to the Tagish tribe, just as the coast tribes had the privilege of doing all the work on the coast side of the mountains, and that one of their number was already working with me unmolested, and likely to continue so, nine of them came over, and in fear and trembling began to pack down to the lake. After they were at work for a few days some of the Chilkoots came out and also started to work. Soon I had quite a number at work and was getting my stuff down quite fast. But this good fortune was not to continue. Owing to the prevailing wet, cold weather on the mountains, and the difficulty of getting through the soft wet snow, the Indians soon began to quit work for a day or two at a time, and to gamble with one another for the wages already earned. Many of them wanted to be paid in full, but this I positively refused, knowing that to do so was to have them all apply for their earnings and leave me until necessity compelled them to go to work again. I once for all made them distinctly understand that I would not pay any of them until the whole of the stuff was down. As many of them had already earned from twelve to fifteen dollars each, to lose which was a serious matter to them, they reluctantly resumed work and kept at it until all was delivered. This done, I paid them off, and set about getting my outfit across the lake, which I did with my own party and the two Peterborough canoes which I had with me.

A word or two about these canoes may not be out of place. They were made by the Ontario Canoe Company, of Peterborough. Both were of special make and somewhat outside of the company's usual style of build. One was 18 feet long, the other 19—both 40 inch beam and 18 inches deep. They were built of basswood, the bottom planks being $\frac{3}{8}$ inch thick and the sides $\frac{1}{4}$ inch. They were extra strong, and higher at the bow and stern than the usual make. When dry they weighed about 140 pounds each, so that two men could without much difficulty carry them. They would each hold two men and 1,400 pounds without being at all overloaded, and could with ease be then driven 4 to $4\frac{1}{2}$ miles per hour. I had them furnished with movable canvas decks, which could be fitted on, and made the canoe almost water-tight. These two canoes travelled about 3,000 miles by rail and about 1,000 miles by steamship before being brought into service. They did considerable work on Chilkoot and Taiya Inlets, and were then packed over to the head of Lewes River (Lake Lyndeman), from where they were used in making the survey of Lewes River. In this work they made about 650 landings. They were then transported on sleighs from the boundary on Lewes River to navigable water on the Porcupine.

In the spring of 1888 they descended the latter, heavily loaded, and through much rough water, to the mouth of Bell's River, and up it to McDougall's Pass. They were then carried over the pass to Poplar River and were used in going down the latter to Peel's River, and thence up Mackenzie River 1,400 miles; or, exclusive of railway and ship carriage, they were carried about 170 miles and did about 2,500 miles of work for the expedition, making in all about 1,700 landings in no easy manner and going through some very bad water. I left them at Fort Chipewyan in fairly good condition, and, with a little painting, they would go through the same ordeal again.

After getting all my outfit over to the foot of Lake Lyndeman I set some of the party to pack it to the head of Bennet Lake. The stream between these two lakes is too shallow and rough to permit of canoe navigation, and everything had to be portaged the greater part of the way.

I employed the rest of the party in looking for timber to build a boat to carry my outfit of provisions and implements down the river to the vicinity of the International Boundary, a distance of about 700 miles. It took several days to find a tree large enough to make plank for the boat I wanted, as the timber around the upper end of the lake is small and scrubby. My boat was finished on the evening of the 11th of July, and on the 12th I started a portion of the party to load up the large boat, and go ahead with it and the outfit to the cañon. They had instructions to examine the cañon and, if necessary, to carry a part of the outfit past it—in any case, enough to support the party back to the coast should accident necessitate such procedure. With the rest of the party I started to carry on the survey, which may now be said to have fairly started ahead on the lakes. This proved tedious work, on account of the stormy weather.

In the summer months there is nearly always a wind blowing in from the coast; it blows down the lakes and produces quite a heavy swell. This would not prevent the canoes going with the decks on, but, as we had to land every mile or so, the rollers breaking on the generally flat beach proved very troublesome. On this account I found I could not average more than ten miles per day on the lakes, little more than half of what could be done on the river.

The survey was completed to the cañon on the 20th of July. There I found the party with the large boat had arrived on the 18th, having carried a part of the supplies past the cañon, and were awaiting my arrival to run through it with the rest in the boat. Before doing so, however, I made an examination of the cañon. The rapids below it, particularly the last rapid of the series (called the White Horse by the miners), I found would not be safe to run. I sent two men through the cañon in one of the canoes to await the arrival of the boat, and to be ready in case of an accident to pick us up. Every man in the party was supplied with a life-preserver, so that should a casualty occur we would all have floated. Those in the canoe got through all right; but they would not have liked to repeat the trip. They said the canoe jumped about a great deal more than they thought it would, and I had the same experience when going through in the boat.

The passage through is made in about three minutes, or at the rate of about 12½ miles an hour. If the boat is kept clear of the sides there is not much danger in high water; but in low water there is a rock in the middle of the channel, near the upper end of the cañon, that renders the passage more difficult. I did not see this rock myself, but got my information from some miners I met in the interior, who described it as being about 150 yards down from the head and a little to the west of the middle of the channel. In low water it barely projects above the surface. When I passed through there was no indication of it, either from the bank above or from the boat.

The distance from the head to the foot of the cañon is five-eighths of a mile. There is a basin about midway in it about 150 yards in diameter. This basin is circular in form, with steep sloping sides, about 100 feet high. The lower part of the cañon is much rougher to run through than the upper part, the fall being apparently much greater. The sides are generally perpendicular, about 80 to 100 feet high, and consist of basalt, in some places showing hexagonal columns.

The "White Horse" Rapids are about three-eighths of a mile long. They are the most dangerous rapids on the river, and are never run through in boats except by accident. They are confined by low basaltic banks, which, at the foot, suddenly close in and make the channel about 30 yards wide. It is here the danger lies, as there is a sudden drop and the water rushes through at a tremendous rate, leaping and seething like a cataract. The miners have constructed a portage road on the west side, and put down rollways in some places on which to shove their boats over. They have also made some windlasses with which to haul their boats up hill, notably one at the foot of the cañon. This roadway and the windlasses must have cost them

many hours of hard labor. Should it ever be necessary, a tramway could be built past the cañon on the east side with no great difficulty. With the exception of the "Five Fingers Rapid" (the Rink Rapid of Schwatka), it appears this is the only serious rapid on the whole length of the river.

Rink Rapid is formed by several islands standing in the channel and backing up the water so much as to raise it about a foot, causing a swell below for a few yards. The islands are composed of conglomerate rock, similar to the cliffs on each side of the river, whence one would infer that there has been a fall here in past ages. For about two miles below the rapid there is a pretty swift current, but not enough to prevent the ascent of a steamboat of moderate power, and the rapids themselves I do not think would present any serious obstacle to the ascent of a good boat. In very high water warping might be required. Six miles below these rapids are what are known as "Little Rapids." This is simply a barrier of rocks, which extends from the westerly side of the river about half way across. Over this barrier there is a ripple which would offer no great obstacle to the descent of a good canoe. On the easterly side there is no ripple, and the current is smooth and the water apparently deep. I tried with a 6 foot paddle, but could not reach the bottom.

On the 11th of August I met a party of miners coming out who had passed Stewart River a few days before. They saw no sign of Dr. Dawson having been there. This was welcome news for me, as I expected he would have reached that point long before I arrived, on account of the many delays I had met with on the coast range. These miners also gave me the pleasant news that the story told at the coast about the fight with the Indians at Stewart River was false, and stated substantially what I have already repeated concerning it. The same evening I met more miners on their way out, and the next day met three boats, each containing four men. In the crew of one of them was a son of Capt. Moore, from whom the captain got such information as induced him to turn back and accompany them out.

Next day, the 13th, I got to the mouth of the Pelly, and found that Dr. Dawson had arrived there on the 11th. The doctor also had experienced many delays, and had heard the same story of the Indian uprising in the interior. I was pleased to find that he was in no immediate want of provisions, the fear of which had caused me a great deal of uneasiness on the way down the river, as it was arranged between us in Victoria that I was to take with me provisions for his party to do them until their return to the coast. The doctor was so much behind the time arranged to meet me that he determined to start for the coast at once. I therefore set about making a short report and plan of my survey to this point: and, as I was not likely to get another opportunity of writing at such length for a year, I applied myself to a correspondence designed to satisfy my friends and acquaintances for the ensuing twelve months. This necessitated three days' hard work.

On the morning of the 17th the doctor left for the outside world, leaving me with a feeling of loneliness that only those who have experienced it can realize. I remained at the mouth of the Pelly during the next day taking magnetic and astronomical observations, and making some measurements of the river. On the 19th I resumed the survey, and reached White River on the 25th. Here I spent most of a day trying to ascend this river, but found it impracticable, on account of the swift current and shallow and very muddy water. The water is so muddy that it is impossible to see through one-eighth of an inch of it. The current is very strong, probably eight miles or more per hour, and the numerous bars in the bed are constantly changing place. After trying for several hours, the base men succeeded in doing about half a mile only, and I came to the conclusion that it was useless to try to get up this stream to the boundary with canoes. Had it proved feasible I had intended making a survey of this stream to the boundary, to discover more especially the facilities it offered for the transport of supplies in the event of a survey of the International Boundary being undertaken.

I reached Stewart River on the 26th. Here I remained a day taking magnetic observations, and getting information from a miner, named McDonald, about the country up that river. McDonald had spent the summer up the river prospecting and exploring. His information will be given in detail further on.

Fort Reliance was reached on the 1st of September, and Forty-Mile River (Cone-Hill River of Schwatka) on the 7th. In the interval between Fort Reliance and Forty-Mile River there were several days lost by rain.

At Forty-Mile River I made some arrangements with the traders there (Messrs. Harper & McQuestion) about supplies during the winter, and about getting Indians to assist me in crossing from the Pelly or Yukon to the head of the Porcupine, or perhaps on to the Peel River. I then made a survey of the Forty-Mile River up to the cañon. I found the cañon would be difficult of ascent, and dangerous to descend, and, therefore, concluded to defer further operations until the winter, and until after I had determined the longitude of my winter post near the boundary, when I would be in a much better position to locate the intersection of the International Boundary with this river, a point important to determine on account of the number and richness of the mining claims on the river.

I left Forty-Mile River for the boundary line between Alaska and the North-West Territories on the 12th September, and finished the survey to that point on the 14th. I then spent two days in examining the valley of the river in the vicinity of the boundary to get the most extensive view of the horizon possible, and to find a tree large enough to serve for a transit stand.

Before leaving Toronto I got Mr. Foster to make large brass plates with V's on them, which could be screwed firmly to a stump, and thus be made to serve as a transit stand. I required a stump at least 22 inches in diameter to make a base large enough for the plates when properly placed for the transit. In a search which covered about four miles of the river bank, on both sides, I found only one tree as large as 18 inches. I mention this fact to give an idea of the size of the trees along the river in this vicinity. I had this stump enlarged by firmly fixing pieces on the sides so as to bring it up to the requisite size. This done, I built around the stump a small transit house of the ordinary form and then mounted and adjusted my transit. Meanwhile, most of the party were busy preparing our winter quarters and building a magnetic observatory. As I had been led to expect extremely low temperatures during the winter, I adopted precautionary measures, so as to be as comfortable as circumstances would permit during our stay there.

A few remarks descriptive of our residence may not be uninteresting.

After clearing away the top soil and excavating some distance into the side of the hill for a foundation, the bottom round of the house was laid and imbedded in the place so cleared; the next round of logs was then put up and fitted in place; it was then rolled off, and on top of the first round was laid a thick layer of moss; the second round of logs was then put back in its place on top of the moss, which was so thick that the second round did not lie on the saddles at the corners, but rode on the moss. This was done with each succeeding round until the requisite height was reached, when the ordinary kind of shanty roof, consisting of poles, was put on. On these was laid a layer of moss about one foot thick, and on this about one foot of clay. In the roof were two ventilators, which could be closed altogether if necessary.

To heat the building a large stone furnace was built, in size 3 by 8 ft.; the front end of this was fashioned into a fireplace, with oven on top for cooking; the other end was formed into a chimney. The structure was a large mass of stones bound together by a tough white clay, which we found in the vicinity, and which baked hard and white, and did not crack with the heat. When this mass was once heated, which it took two days to do, it retained the heat for a long time.

With the weight of the roof and walls the moss between the logs was so pressed that it filled every crevice and almost made a solid wall. During the winter the ventilators were kept open all the time; yet the lowest temperature observed in the house during our stay was 48° Fahrenheit; the average in the morning before the fire was lighted was about 60° Fahrenheit.

After finishing our building I mounted a declinometer and bifilar which were given me by Mr. Carpmael, Director of the Meteorological Service of Canada, and continued regular observations with them until I left for Porcupine River.

Astronomical Determinations of the Latitude and Longitude at Observatory on the Pelly-Yukon during the Winter of 1887-88.

I found the levels furnished for use with the astronomical transit, as made by Fauth, to be useless. Instead of being sealed hermetically they were sealed by a plate bevelled into each end with a ground joint, this plate being cemented in. During the summer the cement softened and allowed the contents to run out. Early in the season I had noticed one of them leaking; I then took every possible precaution to save the other one, but without avail, as they were both empty when I wanted to use them. Fortunately, I had some pure alcohol with me for preserving specimens in; with this I refilled one of the tubes, and as I also had some rubber corks, one of which fortunately fitted the bore of the tubes, I cut it in two, and stopped the ends with it. I found this to answer the purpose very well.

Before commencing work with this level I made a determination of the value in arc of its divisions. This I did by setting it on a bar about 12 feet long, on each end of which a metal plate was fixed. In one of these plates a fine slit was made, which was rested on the edge of a knife fixed in a stump; the other plate was placed on the end of a micrometer screw, reading to ·0001 of an inch; the bubble was made to traverse the length of its run several times by turning the screw; the difference of height of the movable end was known from the readings of the micrometer, and from the known length of the bar; the angle moved through was easily deduced. I made the first determination when the temperature was 28° Fah. Three determinations were made and the mean used as the true value; the three stood as follows, expressed in seconds of arc: 1st, 2″08; 2nd, 1″98; 3rd, 2″03; mean, 2″03. A careful determination made in the same way when the temperature was 41° below zero gave the value in arc 2″41. I interpolated between these values for the different temperatures at the time of the observations.

The reflecting telescope intended for the observation of occultations of stars by the moon, having got out of order, owing, I suppose, to the continued damp, cool weather during the season, I had to fit up a tourist's telescope to take its place. Unfortunately, of all the occultations arranged for with Mr. King, before leaving Ottawa, through the two lunations of October-November and November-December, of which about sixty would occur here, none were observed.

Soon after getting my transit mounted and adjusted I got a culmination of the moon on the 29th September. I intended this as a check on the survey, and as a basis for the computation of the times of the occultations; but I did not see the moon, nor a star again until November, after both lunations of the programme were over. I then computed a lot of occultations in the next lunation, but was as unfortunate with them as with the others.

In order to get all the data possible to determine the longitude of my observatory, I took every moon culmination I could get, all through the months of November, December, January, and a part of February. To make these as accurate as possible, I observed the following method. A list of stars was selected succeeding each other in right ascension, at intervals of four or five minutes as nearly as possible, and containing ten stars. Their position was such that the moon transited about midway in the group. The list contained, as far as possible, four moon-culminating stars, two polar stars, and four stars near the zenith. The first half of the group was observed with the transit clamp east, the transit of the moon's limb was then observed, the telescope then turned clamp west and the other half of the stars observed. From the star transits were deduced, by the method of "least squares," the correction to the time of the passage of the moon's limb, and the azimuth and collimation errors of the transit. The collimation and azimuth error were applied with their proper sign to the moon at its transit; thus the right ascension of the moon was known for the place, and from the Ephemeris right ascension at its transit at Washington, or the right ascension at its upper and lower transit at Greenwich, the longitude of the observatory was deduced.

I found the azimuth of the transit remain very steady during the mild weather in the fall; but when the cold weather set in, and especially during one severe spell,

it was very unsteady, though, perhaps, not more so than the ordinary form of transit stand would have been. Many of the observations were taken when the thermometer was 40 to 50 degrees below zero, and it must be confessed that such a degree of cold would try any kind of stand.

It is not to be supposed that the same variation would be found in every other stump that was found in the one upon which my transit was mounted, but it may be of interest to note that the variation of azimuth always had the same direction with a decrease of temperature, and that the direction was reversed when the temperature rose. Another result of a decrease of temperature was the contraction of the stump-stand, which necessitated replacing of the brass plates. With a decrease of temperature the level also changed, but always in a constant direction, which was reversed when the temperature changed again, so that at the same temperature the level reading would be the same. I found the change of level so great that it would in the course of a day run the bubble out of sight, and necessitate a readjustment of both level and azimuth. It is not certain that this variation arose from change in the stump, but it was most probably due to changes in the ground around it; so that the stump was probably as good a stand as I could have had, and saved the carriage of about two hundred pounds into the country and out again. Of all the occultations computed (about one hundred) only three were observed. These are given further on.

I here insert a table of the results of the moon culminations I observed at my observatory. All the culminations observed in 1887 were computed from the British Ephemeris by using the right ascension of the moon's bright limb at upper and lower transit at Greenwich. All culminations observed in 1888 were computed from the American Ephemeris, by using the moon's right ascension at meridian passage at Washington. These were occasionally checked by computing from the hourly Ephemeris. I give date of observation, the number of stars observed, the deduced right ascension of the moon's bright limb, and the resulting longitude, for the purpose of comparison, first giving the observations taken on the moon's bright limb when [illegible]cent, following with those taken when it was waning :

Observations on 1st Limb.

Date.	No. of Stars.	Deduced R. A. of Moon's Limb.	Deduced Longitude in Time.
		h. m. s.	h. m. s.
Sept. 29, 1887.....	7	23 14 59·47	9 23 35·89
Nov. 23 "	9	23 30 40·62	" 24·19
" 25 "	10	1 02 24·39	" 26·61
Dec. 21 "	5	23 59 02·65	" 28·02
" 22 "	6	0 44 59·11	" 23·73
" 23 "	8	1 30 39·34	" 21·54
" 27 "	6	4 46 14·33	" 27·32
" 29 "	8	6 37 24·78	" 33·16
Jan. 18, 1888.....	8	0 25 46·91	" 29·15
" 20 "	8	1 57 41·35	" 30·19
" 21 "	8	2 44 25·21	9 23 27·50
" 23 "	9	4 23 12·90	" " 37·72
" 26 "	8	7 09 44·15	" " 30·92
Feb. 23 "	8	7 39 49·33	" " 32·68
	Mean		9 23 29·47
	Probable error of mean		3.01s.

It would be a waste of time to sum these by weights, having regard to the moon's rate of motion, the number of stars observed, and the probable error of each night's work, as the accuracy of the result depends mainly on the accuracy of the

observed transit of the moon's limb. This could be deduced from the observations themselves, but as I had not time when observing to do this, and have not done it since, I do not consider it worth the time to do it now, as it would affect the mean result very little.

Observations on 2nd Limb.

Date.	No. of Stars.	Deduced R. A. of Moon's Limb. h.	m.	s.	Deduced Longitude in Time. h.	m.	s.
Nov. 30, 1887.....	3	.....			9	23	40·42
Dec. 1 "	8	6	04	00·16	"	"	44·18
" 2 "	6	7	00	27·73	"	"	52·24
" 3 "	7	7	57	27·54	"	"	46·07
" 6 "	7	10	46	19·81	"	"	39·96
" 7 "	4	11	41	28·83	"	"	45·44
" 29 "	8	6	39	41·95	"	"	39·70
Jan. 31, 1888.....	8	12	02	21·99	"	"	44·87
	Mean.....				9	23	44·11
	Probable error of mean						2·81s

The mean of both is 9h. 23m. 36·79s. in time, or in arc 140° 54′ 11″.8, west of Greenwich. It will be noticed that on the 29th December both limbs of the moon were observed. The moon arrived at opposition that evening a little more than an hour before it transited at my station, so that it was sensibly full on both limbs at the time of my observation. The mean of the longitudes deduced from that night's work agrees very closely with the mean of the two series.

It would seem from the result that in the case of the first limb I anticipate contact of the limb with the wire, and in the case of the second limb I am tardy. If I may judge of the relative value of the separate determinations by my nervous condition at the time of observation, I would give that on the first limb the greater weight, as those observations were taken early in the evening, when my system was in its normal condition; but when observing on the second limb it was much later and I was somewhat wearied and drowsy, there being not enough of the work, nor its regularity sufficient, to accustom me thoroughly to it.

Three occultations were observed; I did not compute the longitude from them, as I had not time. But I always made the preparatory computation twice over, and sometimes three times, so that I had the time of occultation very close, for the longitude used in the computation (9h. 23m. 36s.) I found the computed and the observed time so nearly the same that it was probable the difference was chiefly due to personal error in observation. I was, therefore, not so anxious to deduce the longitude from them as I otherwise would have been. Mr. W. F. King, Chief Inspector of Surveys, has computed the longitude from one of the occultations, the result of which I give.

December 5, 1887—Occultation of Alpha Leonis. Chronometer time of immersion 1h. 27m. 12·6s. Emersion not visible. Chronometer fast 9h. 31m. 42·51s.

This occultation was observed in daylight near the horizon, and with a small telescope, so it cannot be called good.

January 23, 1888—Occultation of 75 Tauri. Chronometer time of immersion 12h. 4m. 16·25s. Emersion not visible. Chronometer fast 9h. 33m. 23·42s.

January 23, 1888—Occultation of Alpha Tauri. Chronometer time of immersion 16h. 31m. 07·55s. Emersion 17h. 18m. 49·35s. Chronometer fast for immersion 9h. 33m. 23·81s.; for emersion 9h. 33m. 23·87s.

Mr. King's longitudes in time, computed from the times of immersion and emersion of the last star, are respectively 9h. 23m. 45·28s., and 9h. 24m. 11·22s. In the case of this occultation the immersion was by the moon's dark limb, and there was no difficulty in observing it, but my telescope was much too small to show when the star emerged from the moon's bright limb, and the emersion was not noted

until the star stood out clear from the moon, probably a second or more too late, the effect of which would be to make the resulting longitude too great.

I determined the latitude of a point 60 feet north of my transit stand by setting up very carefully my 4-inch transit in the prime vertical. To insure all possible steadiness I suspended heavy weights from the tension screw of the instrument, so that the foot screws and the rest of the instrument were almost as rigid as if solid. By several trials I very carefully determined the value of a division of the striding level of the instrument, and found it to be 20″, and it was sensitive enough to plainly show one-fourth of this, and less than that could be estimated. I used on the telescope the eye-piece of the astronomical transit, which gave me power enough to see distinctly when a star crossed the wires, and yet was not too powerful for proper definition. I used three wires in the telescope, of which the aperture was 1 inch and the focal length 10 inches. I had a reference object fixed west of the instrument about half a mile, consisting of a box with an inch and a half slit in one side of it, which was covered with a piece of white cotton. In the box was placed a candle, the light of which shone through the cotton in the slit, presenting a bright clear mark, without any radiation of light. Just before observing a star transit the instrument was carefully levelled, then pointed on the R. O. and then on the star, and the passage over the wires observed; the level was then read, and the telescope again pointed to the R. O to see that no movement had taken place in the interval.

On the 24th of October, 1887, I observed the following prime vertical transits of stars east and west of the meridian; η Draconis, west transit, circle south; η Cephei, east transit, circle north; 36 Draconis, west transit, circle north. The chronometer error was determined by a few star transits. When clouds prevented further observations that night, the latitude deducted from the several transits stood as follows:—

η Draconis 64° 40′ 57″·2.
η Cephei 64° 40′ 57″·4.
36 Draconis 64° 40′ 58″·4.
Mean of all 64° 40′ 57″·7.

January 26, 1888—I got both east and west transits of ε Cassiopeæ, but the sky was hazy, and the thermometer was—30°, so that the observation cannot be considered good. The latitude deduced from it was 64° 41′ 06″·4.

January 3, 1888, and February 27 and 28—I observed, with the dip circle, for magnetic dip, total force, and declination. The values of these at the place will be appended to this report, as will the readings of the declinometer furnished by Mr. Carpmael, Director of the Meteorological Service of Canada. This was read twice a day, the times being those when the needle was at its greatest eastern and western variation for the day. These times were determined by observing its position every hour for about ten days, and were found to be respectively 7h. 30m. a.m., and 1h. 30m. p.m.

The weather throughout the winter was unusually stormy and snowy, which seriously interfered with the arrangements made before I left Ottawa. In fact it might be said it altogether set them aside; still, the observations I was able to get will give a fair approximation to the longitude of the observatory, the probable error of the result of all being about three seconds of time, or in land measure about 30 chains, or three-eighth of a mile.

Survey of Forty Mile River, from it Mouth to the International Boundary Line.

After computing the longitude from all the observations I had got up to the 1st February, I took two of my men and my instruments, and started for Forty-Mile River to continue the survey up the same to the International Boundary. After three days tiresome marching through the deep, soft snow, I reached the mouth of Forty-Mile River. Here I remained two days resting and preparing to continue the survey up the river. On the 9th of February I started with the survey from where I had left it in the summer, as already mentioned.

During the progress of this work the weather was cold, and as the days were only four or five hours long the progress was necessarily slow, so that I did not complete the survey to the boundary until the 12th. The distance from the mouth of the Forty-Mile River up it to the boundary is, by the river, twenty-three miles. I marked the intersection of the river by the boundary by blazing trees on both sides and marking on some of the trees the letters "A" and "C" on the west and east sides respectively, for Alaska and Canada.

The natural features of the ground here afford also a good mark. On the north side of the river two small creeks fall into Forty-Mile River, almost together, and between them there is a sharp rocky mound about 150 feet high. This mound stands where the boundary crosses the river, and from this point one can see northwards up the valleys of the creeks for several miles. This is the first place on the river where such a distant view can be had.

I returned to the post at the mouth of the river, and spent two days with the traders Harper and McQuestion and the miners who were camped around.

Harper, McQuestion & Co., moved from Stewart River down to this point in the spring of 1887, so as to be where most of the miners were located. On Forty-Mile River, in the season of 1886, coarse gold was found, the first discovery on the Lewes or any of its tributaries. Coarse gold is the desideratum of all gold miners, and as soon as the news of the discovery spread to the other mining camps, where nothing but fine or dust gold had yet been found, they all repaired to the coarse gold diggings on Forty-Mile.

About one hundred miners wintered in the country, most of whom camped at Forty-Mile. A few wintered down at the old trading post built by F. Mercier, and named by him Belle Isle. This post is where Lieut. Schwatka located the International Boundary, but it is about twelve miles below the boundary by my survey and observations.

When I was at Forty-Mile River the miners were very anxious to see me, and to know our mining regulations and laws. I explained everything they inquired about as fully as my knowledge and the documents at my disposal would permit. Many of them who were used to the United States system of each mining community making its own by-laws, based on the general mining law of the country, and electing their own recorder to attend to the regulations and see them carried out, thought some of our regulations rather stringent and hard. I heard their statements and answered such of them as I could, and also promised to lay their views before the Department. This I have already done in a report sent by me in the spring of 1888. As this report is of purely administrative import, it is not necessary to quote it here.

During the winter there were many cases of sickness at Forty-Mile, most of them of scurvy. There were three deaths, only one of which was due to scurvy.

I returned to my quarters on the 17th February, and immediately set the party at work drawing the canoes and instruments, and about four months' provisions, down to Belle Isle, about fifteen miles down the river from my house. This was to be our starting point for the Mackenzie River.

Section 2.

Description of the Pelly-Yukon, its Affluent Streams, and the Adjacent Country.

I will now give, from my own observation and from information received, a more detailed description of the Lewes River, its affluent streams, and the resources of the adjacent country.

For the purpose of navigation a description of the Lewes River begins at the head of Lake Bennet. Above that point, and between it and Lake Lyndeman, there is only about three-quarters of a mile of river, which is not more than 50 or 60 yards wide, and 2 or 3 feet deep, and is so swift and rough that navigation is out of the question.

Lake Lyndeman is about five miles long and half a mile wide. It is deep enough for all ordinary purposes. Lake Bennet is twenty-six and a-quarter miles long, the upper fourteen of which are about half a mile wide. About midway in its length

an arm comes in from the west which Schwatka appears to have mistaken for a river, and named Wheaton River. This arm is wider than the other arm down to that point, and is reported by Indians to be longer and heading in a glacier which lies in the pass at the head of Chilkoot Inlet. This arm is, as far as seen, surrounded by high mountains, apparently much higher than those on the arm we travelled down. Below the junction of the two arms the lake is about one and a half miles wide, with deep water. Above the forks the water of the east branch is muddy. This is caused by the streams from the numerous glaciers on the head of the tributaries of Lake Lyndeman.

A stream which flows into Lake Bennet at the south-west corner is also very dirty, and has shoaled quite a large portion of the lake at its mouth. The beach at the lower end of this lake is comparatively flat and the water shoal. A deep, wide valley extends northwards from the north end of the lake, apparently reaching to the cañon, or a short distance above it. This may have been originally a course for the waters of the river. The bottom of the valley is wide and sandy, and covered with scrubby timber, principally poplar and pitch-pine. The waters of the lake empty at the extreme north-east angle through a channel not more than one hundred yards wide, which soon expands into what Schwatka called Lake Nares. Through this narrow channel there is quite a current, and more than 7 feet of water, as a 6 foot paddle and a foot of arm added to its length did not reach the bottom.

The hills at the upper end of Lake Lyndeman rise abruptly from the water's edge. At the lower end they are neither so steep nor so high.

Lake Nares is only two and a half miles long, and its greatest width is about a mile; the water is not deep, but it is navigable for boats drawing 5 or 6 feet of water. It is separated from Lake Bennet by a shallow sandy point of not more than 200 yards in length.

No streams of any consequence empty into either of these lakes. A small river flows into Lake Bennet on the west side, a short distance north of the fork, and another at the extreme north-west angle, but neither of them are of any consequence in a navigable sense. The former seems to be what Schwatka referred to as Wheaton River.

Lake Nares flows through a narrow curved channel into Bove Lake (Schwatka). This channel is not more than 600 or 700 yards long, and the water in it appears to be sufficiently deep for boats that could navigate the lake. The land between the lakes along this channel is low, swampy, and covered with willows, and, at the stage in which I saw it, did not rise more than 3 feet above the water. The hills on the south-west side slope up easily, and are not high; on the north side the deep valley already referred to borders it; and on the east side the mountains rise abruptly from the lake shore.

Bove Lake (called Tagish Lake by Dr. Dawson) is about a mile wide for the first two miles of its length, when it is joined by what the miners have called the Windy Arm. One of the Tagish Indians informed me they called it Takone Lake. Here the lake expands to a width of about two miles for a distance of some three miles, when it suddenly narrows to about half a mile for a distance of a little over a mile, after which it widens again to about a mile and a half or more.

Ten miles from the head of the lake it is joined by the Tako Arm from the south. This arm must be of considerable length, as it can be seen for a long distance, and its valley can be traced through the mountains much farther than the lake itself can be seen. It is apparently over a mile wide at its mouth or junction.

Dr. Dawson seems to include Bove Lake and these two arms under the common name of Tagish Lake. This is much more simple and comprehensive than the various names given them by travellers. These waters collectively are the fishing and hunting grounds of the Tagish Indians, and as they are really one body of water, there is no reason why they should not be all included under one name.

From the junction with the Tako Arm to the north end of the lake the distance is about six miles, the greater part being over two miles wide. The west side is very flat and shallow, so much so that it was impossible in many places to get our

canoes to the shore, and quite a distance out in the lake there was not more than 5 feet of water. The members of my party, who were in charge of the large boat and outfit, went down the east side of the lake and reported the depth about the same as I found on the west side, with many large rocks. They passed through it in the night in a rain storm, and were much alarmed for the safety of the boat and provisions. It would appear that this part of the lake requires some improvement to make it in keeping with the rest of the water system with which it is connected.

Where the river debouches from it, it is about 150 yards wide, and for a short distance not more than 5 or 6 feet deep. The depth is, however, soon increased to 10 feet or more, and so continues down to what Schwatka calls Marsh Lake. The miners call it Mud Lake, but on this name they do not appear to be agreed, many of them calling the lower part of Tagish or Bove Lake "Mud Lake," on account of its shallowness and flat muddy shores, as seen along the west side, the side nearly always travelled, as it is more sheltered from the prevailing southerly winds. The term "Mud Lake" is, however, not applicable to this lake, as only a comparatively small part of it is shallow or muddy, and it is nearly as inapplicable to Marsh Lake, as the latter is not markedly muddy along the west side, and from the appearance of the east shore one would not judge it to be so, as the banks appear to be high and gravelly.

Marsh Lake is a little over nineteen miles long, and would average about two miles in width. I tried to determine the width of it as I went along with my survey, by taking azimuths of points on the eastern shore from different stations of the survey; but in only one case did I succeed, as there were no prominent marks on that shore which could be identified from more than one place. The piece of river connecting Tagish and Marsh Lakes is about five miles long, and averages 150 to 200 yards in width, and, as already mentioned, is deep, except for a short distance at the head. On it are situated the only Indian houses to be found in the interior with any pretention to skill in construction. They show much more labor and imitativeness than one knowing anything about the Indian in his native state would expect. The plan is evidently taken from the Indian houses on the coast, which appear to me to be a poor copy of the houses which the Hudson's Bay Company's servants build around their trading posts. These houses do not appear to have been used for some time past, and are almost in ruins. The Tagish Indians are now generally on the coast, as they find it much easier to live there than in their own country. As a matter of fact, what they make in their own country is taken from them by the Coast Indians, so that there is little inducement for them to remain.

The Lewes River, where it leaves Marsh Lake, is about 200 yards wide, and averages this width as far as the cañon. I did not try to find bottom anywhere as I went along, except where I had reason to think it shallow, and there I always tried with my paddle. I did not anywhere find bottom with this, which shows that there is no part of this stretch of the river with less than 6 feet of water at medium height, at which stage it appeared to me the river was at that time.

From the head of Bennet Lake to the cañon the corrected distance is ninety-five miles, all of which is navigable for boats drawing 5 feet or more. Add to this the westerly arm of Bennet Lake, and the Takone or Windy Arm of Tagish Lake, each about fifteen miles in length, and the Tako Arm of the latter lake, of unknown length, but probably not less than thirty miles, and we have a stretch of water of upwards of one hundred miles in length, all easily navigable; and, as has been pointed out, easily connected with Taiya Inlet through the White Pass.

No streams of any importance enter any of these lakes so far as I know. A river, called by Schwatka "McClintook River," enters Marsh Lake at the lower end from the east. It occupies a large valley, as seen from the westerly side of the lake, but the stream is apparently unimportant. Another small stream, apparently only a creek, enters the south-east angle of the lake. It is not probable that any stream coming from the east side of the lake is of importance, as the strip of country between the Lewes and Tes-lin-too is not more than thirty or forty miles in width at this point.

The Tako Arm of Tagish Lake is, so far, with the exception of reports from Indians, unknown; but it is equally improbable that any river of importance enters it, as it is so near the source of the waters flowing northwards. However, this is a question that can only be decided by a proper exploration. The cañon I have already described, and will only add that it is five-eighths of a mile long, about 100 feet wide, with perpendicular banks of basaltic rock from 60 to 100 feet high.

Below the cañon proper there is a stretch of rapids for about a mile; then about half a mile of smooth water; following which are the "White Horse" Rapids, which are three-eighths of a mile long, and unsafe for boats.

The total fall in the cañon and succeeding rapids were measured and found to be 32 feet. Were it ever necessary to make this part of the river navigable it will be no easy task to overcome the obstacles at this point; but a tram or railway could with very little difficulty be constructed along the east side of the river past the cañon.

For some distance below the White Horse Rapids the current is swift and the river wide, with many gravel bars. The reach between these rapids and Lake Labarge, a distance of twenty-seven and a-half miles, is all smooth water, with a strong current. The average width is about 150 yards. There is no impediment to navigation other than the swift current, and this is no stronger than on the lower part of the river, which is already navigated; nor is it worse than on the Saskatchewan and Red Rivers in the more eastern part of our territory.

About midway in this stretch the Tahk-heena River joins the Lewes. This river is apparently about half the size of the latter. Its waters are muddy, indicating its passage through a clayey district. I got some indefinite information about this river from an Indian who happened to meet me just below its mouth, but I could not readily make him understand me, and his replies were a compound of Chinook, Tagish, and signs, and therefore largely unintelligible. From what I could understand with any certainty, the river was easy to descend, there being no bad rapids, and it came out of a lake much larger than any I had yet passed.

Here, I may remark, that I have invariably found it difficult to get reliable or definite information from Indians. The reasons for this are many. Most of the Indians it has been my lot to meet are expecting to make something, and consequently are very chary about doing or saying anything unless they think they will be well rewarded for it. They are naturally very suspicious of strangers, and it takes some time, and some knowledge of their language, to overcome this suspicion and gain their confidence. If you begin at once to ask questions about their country, without previously having them thoroughly understand that you have no unfriendly motive in doing so, they become alarmed, and although you may not meet with a positive refusal to answer questions, you make very little progress in getting desired information. On the other hand, I have met cases where either through fear or hope of reward they were only too anxious to impart all they knew or had heard, and even more if they thought it would please their hearer. I need hardly say that such information is often not at all in accordance with the facts.

I have several times found that some act of mine when in their presence has aroused either their fear, superstition or cupidity. As an instance: on the Bell River I met some Indians coming down stream as I was going up. We were ashore at the time, and invited them to join us. They started to come in, but very slowly, and all the time kept a watchful eye on us. I noticed that my double-barrelled shot gun was lying at my feet loaded, and picked it up to unload it, as I knew they would be handling it after landing. This alarmed them so much that it was some time before they came in, and I don't think they would have come ashore at all had they not heard that a party of white men, of whom we answered the description, were coming through that way (they had learned this from the Hudson's Bay Company's officers), and concluded we were the party described to them. After drinking some of our tea, and getting a supply for themselves, they became quite friendly and communicative.

Again, on the Mackenzie River, while two Indians were coming ashore at my camp, I picked up a telescope to look for a signal across the river. In looking for it I had to point it towards the Indians, who immediately turned and fled. Next day I called at the Indian encampment and explained through my interpreter what I had really done. When they understood it, it caused the camp much amusement.

At Fort Good Hope, on the Mackenzie, I heard of an old Indian who had been a great deal on the Hare River, and could give valuable information regarding it. I asked to have him brought in, that I might question him. In the mean time I set about getting an observation for azimuth, and was busy observing when he came. The interpreter asked me what I was doing; I told him. He asked what I was looking up so much for; I said I was looking at a star. As the time was early in the evening, and the sun well up in the sky, he at first doubted my statement, but, finally believing, he explained to the Indians around what I was doing, and pointed out to them where the star was. They looked up in an awed manner, and walked off. When I finished my observation and inquired for the old man, I was told that he was not inclined to see me. I found him, but he refused to answer any questions, saying that there was no use in telling me anything, for when I could see stars during daylight I could just as easily see all the river, and nothing could convince him to the contrary.

I cite these as instances of what one meets with who comes in contact with Indians, and of how trifles affect them. A sojourn of two or three days with them and the assistance of a common friend would do much to disabuse them of such ideas, but when you have no such aids you must not expect to make much progress.

Lake Labarge is thirty-one miles long. From the upper thirteen it varies from three to four miles in width; it then narrows to about two miles for a distance of seven miles, when it begins to widen again, and gradually expands to about two and a-half or three miles, the lower six miles of it maintaining the latter width. The survey was carried along the western shore, and while so engaged I determined the width of the upper wide part by triangulation at two points, the width of the narrow middle part at three points, and the width of the lower part at three points. Dr. Dawson on his way out made a track survey of the eastern shore. The western shore is irregular in many places, being indented by large bays, especially at the upper and lower ends. These bays are, as a rule, shallow, more especially those at the lower end.

Just above where the lake narrows in the middle there is a large island. It is three and a-half miles long and about half a mile in width. It is shown on Schwatka's map as a peninsula, and called by him Richtofen Rocks. How he came to think it a peninsula I cannot understand, as it is well out in the lake; the nearest point of it to the western shore is upwards of half a mile distant, and the extreme width of the lake here is not more than five miles, which includes the depth of the deepest bays on the western side. It is therefore difficult to understand that he did not see it as an island. The upper half of this island is gravelly, and does not rise very high above the lake. The lower end is rocky and high, the rock being of a bright red color.

At the lower end of the lake there is a large valley extending northwards, which has evidently at one time been the outlet of the lake. Dr. Dawson has noted it and its peculiarities. His remarks regarding it will be found on pages 156-160 of his report entitled "Yukon District and Northern portion of British Columbia," published in 1889.

The width of the Lewes River as it leaves the lake is the same as at its entrance, about 200 yards. Its waters, when I was there, were murky. This is caused by the action of the waves on the shore along the lower end of the lake. The water at the upper end and at the middle of the lake is quite clear, so much so that the bottom can be distinctly seen at a depth of 6 or 7 feet. The wind blows almost constantly down this lake, and in a high wind it gets very rough. The miners complain of much detention owing to this cause, and certainly I cannot complain of a lack of wind while I was on the lake. This lake was named after one Mike

Labarge, who was engaged by the Western Union Telegraph Company, exploring the river and adjacent country for the purpose of connecting Europe and America by telegraph through British Columbia, and Alaska, and across Behring's Straits to Asia, and thence to Europe. This exploration took place in 1867, but it does not appear that Labarge then, nor for some years after, saw the lake called by his name. The successful laying of the Atlantic cable in 1866 put a stop to this project, and the exploring parties sent out were recalled as soon as word could be got to them. It seems that Labarge had got up as far as the Pelly before he received his recall; he had heard something of a large lake some distance further up the river, and afterwards spoke of it to some traders and miners, who called it after him.

After leaving Lake Labarge the river, for a distance of about five miles, preserves a generally uniform width and an easy current of about four miles per hour. It then makes a short turn round a low gravel point, and flows in exactly the opposite of its general course for a mile, when it again turns sharply to its general direction. The current around this curve and for some distance below it—in all four or five miles—is very swift. I timed it in several places and found it from six to seven miles an hour. It then moderates to four or five, and continues so until the Tes-lin-too River is reached, thirty-one and seven-tenths miles from Lake Labarge. The average width of this part of the river is about 150 yards, and the depth is sufficient to afford passage to boats drawing at least 5 feet. It is, as a rule, crooked, and consequently a little difficult to navigate.

The Tes-lin-too was so called by Dr. Dawson—this, according to information obtained by him, being the Indian name. It is called by the miners "Hootalinkwa" or Hotalinqua, and was called by Schwatka, who appears to have bestowed no other attention on it, the Newberry, although it is apparently much larger than the Lewes. This was so apparent that in my interim reports I stated it as a fact. Owing to circumstances already narrated, I had not time while at the mouth to make any measurement to determine the relative size of the rivers; but on his way out Dr. Dawson made these measurements, and his report, before referred to, gives the following values of the cross sections of each stream: Lewes, 3,015 feet; Tes-lin-too, 3,809 feet. In the same connection he states that the Lewes appeared to be about 1 foot above its lowest summer level, while the Tes-lin-too appeared to be at its lowest level. Assuming this to be so, and taking his widths as our data, it would reduce his cross section of the Lewes to 2,595 feet. Owing, however, to the current in the Lewes, as determined by Dr. Dawson, being just double that of the Tes-lin-too, the figures being 5·68 and 2·88 miles per hour, respectively, the discharge of the Lewes, taking these figures again, is 18,664 feet, and of the Tes-lin-too 11,436 feet. To reduce the Lewes to its lowest level the doctor says would make its discharge 15,600 feet.

The water of the Tes-lin-too is of a dark brown color, similar in appearance to the Ottawa River water, and a little turbid. Notwithstanding the difference of volume of discharge, the Tes-lin-too changes completely the character of the river below the junction, and a person coming up the river would, at the forks, unhesitatingly pronounce the Tes-lin-too the main stream. The water of the Lewes is blue in color, and at the time I speak of was somewhat dirty—not enough so, however, to prevent one seeing to a depth of two or three feet.

At the junction of the Lewes and Tes-lin-too I met two or three families of the Indians who hunt in the vicinity. One of them could speak a little Chinook. As I had two men with me who understood his jargon perfectly, with their assistance I tried to get some information from him about the river. He told me the river was easy to ascend, and presented the same appearance eight days journey up as at the mouth; then a lake was reached, which took one day to cross; the river was then followed again for half a day to another lake, which took two days to traverse; into this lake emptied a stream which they used as a highway to the coast, passing by way of the Taku River. He said it took four days when they had loads to carry, from the head of canoe navigation on the Tes-lin-too to salt water on the Taku Inlet; but when they come light they take only one to two days. He spoke also of a stream entering the large lake from the east which came from a distance; but they did not

seem to know much about it, and considered it outside their country. If their time intervals are approximately accurate, they mean that there are about 200 miles of good river to the first lake, as they ought easily to make 25 miles a day on the river as I saw it. The lake takes one day to traverse, and is at least 25 miles long, followed by say 12 of river, which brings us to the large lake, which takes two days to cross, say 50 or 60 more—in all about 292 miles—say 300 to the head of canoe navigation; while the distance from the head of Bennet Lake to the junction is only 188. Assuming the course of the Tes-lin-too to be nearly south (it is a little to the east of it), and throwing out every fourth mile for bends, the remainder gives us in arc three degrees and a quarter of latitude, which, deducted from 61° 40', the latitude of the junction, gives us 58° 25', or nearly the latitude of Juneau City.

To make sure that I understood the Indian aright, and that he knew what he was speaking about, I got him to sketch the river and lake, as he described them, on the sand, and to repeat the same several times.

I afterwards met Mr. T. Boswell, his brother, and another miner, who had spent most of the summer on the river prospecting, and from them I gathered the following: The distance to the first, and only lake which they saw, they put at 175 miles, and the lake itself they call at least 150 miles long, as it took them four days to row in a light boat from end to end. The portage to the sea they did not appear to know anything about, but describe a large bay on the east side of the lake, into which a river of considerable size entered. This river occupies a wide valley, surrounded by high mountains. They thought this river must head near Liard River. This account differs materially from that given by the Indian, and to put them on their guard, I told them what he had told me, but they still persisted in their story, which I find differs a good deal from the account they gave Dr. Dawson, as incorporated in his report.

Many years ago, sixteen I think, a man named Monroe prospected up the Taku and learned from the Indians something of a large lake not far from that river. He crossed over and found it, and spent some time prospecting, and then recrossed to the sea. This man had been at Forty-Mile River, and I heard from the miners there his account of the appearance of the lake, which amounted generally to this: "The Boswells did not know anything about it." It was unfortunate the Boswells did not remain at Forty Mile all winter, as by a comparison of recollections they might have arrived at some correct conclusion.

Conflicting as these descriptions are, one thing is certain: this branch, if it has not the greater discharge, is the longer and more important of the two, and offers easy and uninterrupted navigation for more than double the distance which the Lewes does, the cañon being only ninety miles above the mouth of the Tes-lin-too. The Boswells reported it as containing much more useful timber than the Lewes, which indeed one would infer from its lower altitude.

Assuming this as the main river, and adding its length to the Lewes-Yukon below the junction, gives upwards of 2,200 miles of river, fully two-thirds of which run through a very mountainous country, without an impediment to navigation.

Some indefinite information was obtained as to the position of this river in the neighborhood of Marsh Lake tending to show that the distance between them was only about thirty or forty miles.

Between the Tes-lin-too and the Big Salmon, so called by the miners, or D'Abbadie by Schwatka, the distance is thirty-three and a-half miles, in which the Lewes preserves a generally uniform width and current. For a few miles below the Tes-lin-too it is a little over the ordinary width, but then contracts to about two hundred yards which it maintains with little variation. The current is generally from four to five miles per hour.

The Big Salmon I found to be about one hundred yards wide near the mouth, the depth not more than four or five feet, and the current, so far as could be seen, sluggish. None of the miners I met could give me any information concerning this stream; but Dr. Dawson was more fortunate, and met a man who had spent most of the summer of 1887 prospecting on it. His opinion was that it might be navigable

for small stern-wheel steamers for many miles. The valley as seen from the mouth is wide and gives one the impression of being occupied by a much more important stream. Looking up it, in the distance could be seen many high peaks covered with snow. As the date was August it is likely they are always so covered, which would make their probable altitude above the river 5,000 feet or more.

Dr. Dawson in his report incorporates fully the notes obtained from the miners. I will trespass so far on these as to say that they called the distance to a small lake near the head of the river 190 miles from the mouth. This lake was estimated to be four miles in length; another lake about twelve miles above this was estimated to be twenty-four miles long, and its upper end distant only about eight miles from the Tes-lin-too. These distances if correct make this river much more important than a casual glance at it would indicate; this, however, will be more fully spoken of under its proper head.

Just below the Big Salmon the Lewes takes a bend of nearly a right angle. Its course from the junction with the Tahk-heena to this point is generally a little east of north; at this point it turns to nearly west for some distance. Its course between here and its confluence with the Pelly is north-west, and I may add it preserves this general direction down to the confluence with the Porcupine. The river also changes in another respect; it is generally wider, and often expands into what might be called lakes, in which are islands. Some of the lakes are of considerable length, and well timbered.

To determine which channel is the main one, that is, which carries the greatest volume of water, or is best available for the purposes of navigation, among these islands, would require more time than I could devote to it on my way down; consequently, I cannot say more than that I have no reason to doubt that a channel giving 6 feet or more of water could easily be found. Whenever in the main channel I had reason to think the water shallow I tried it with my paddle, but always failed to find bottom, which gives upwards of 6 feet. Of course, I often found less than this, but not in what I considered the main channel.

Thirty-six and a quarter miles below the Big Salmon, the Little Salmon—the Daly of Schwatka—enters the Lewes. This river is about sixty yards wide at the mouth, and not more than two or three feet in depth. The water is clear and of a brownish hue; there is not much current at the mouth, nor as far as can be seen up the stream. The valley which, from the mouth, does not appear extensive, bears north-east for some distance, when it appears to turn more to the east. Six or seven miles up, and apparently on the north side, some high cliffs of red rock, apparently granite, can be seen. It is said that some miners have prospected this stream, but I could learn nothing definite about it.

Lewes River makes a turn here to the south-west, and runs in that direction six miles, when it again turns to the north-west for seven miles, and then makes a short sharp turn to the south and west around a low sandy point, which will at some day in the near future be cut through by the current, which will shorten the river three or four miles.

Eight miles below Little Salmon River a large rock called the Eagle's Nest stands up in a gravel slope on the easterly bank of the river. It rises about 500 feet above the river and is composed of a light grey stone What the character of this rock is I could not observe, as I saw it only from the river, which is about a quarter of a mile distant. On the westerly side of the river there are two or three other isolated masses of apparently the same kind of rock. One of them might appropriately be called a mountain; it is south-west from the Eagle's Nest and distant from it about three miles.

Thirty-two miles below Eagle's Nest Rock, Nordenskiold River enters from the west. It is an unimportant stream, being not more than one hundred and twenty feet wide at the mouth, and only a few inches deep. The valley as far as can be seen, is not extensive, and, being very crooked, it is hard to tell what its general direction is.

The Lewes, between the Little Salmon and the Nordenskiold, maintains a width of from two to three hundred yards, with an occasional expansion where there are islands. It is serpentine in its course most of the way, and where the Nordenskiold joins it is very crooked, running several times under a hill, named by Schwatka Tantalus Butte, and in other places leaving it, for a distance of eight miles. The distance across from point to point is only half a mile.

Below this to Rink Rapids, as called by Schwatka, or Five Finger Rapids by the miners, from the fact that five large masses of rock stand in mid-channel, the river assumes its ordinary straightness and width, with a current from four to five miles per hour. I have already described Rink Rapids; I do not think they will prove anything more than a slight obstruction in the navigation of the river. A boat of ordinary power would probably have to help herself up with windlass and line in high water.

Below the rapids, for about two miles, the current is strong—probably six miles per hour—but the water seems to be deep enough for any boat that is likely to navigate it.

Six miles below this, as already noticed, "Little Rapids" are situated. They are of no great importance, the westerly half of the stream only being obstructed. The easterly half is not in any way affected, the current being smooth and the water deep.

Below Rink Rapids about two miles a small stream enters from the east. It is called by Dr. Dawson Tatshun River. It is not more than 30 or 40 feet wide at the mouth, and contains only a little clear, brownish water. Here I met the only Indians seen on the river between Tes-lin-too and Stewart Rivers. They were engaged in catching salmon at the mouth of the Tatshun, and were the poorest and most unintelligent Indians it has ever been my lot to meet. It is needless to say that none of our party understood anything they said, as they could not speak a word of any language but their own. I tried by signs to get some information from them about the stream they were fishing in, but failed. I tried in the same way to learn if there were any more Indians in the vicinity, but again utterly failed. I then tried by signs to find out how many days it took to go down to Pelly River, but although I have never known these signs to fail in eliciting information in any other part of the territory, they did not understand. They appeared to be alarmed by our presence; and, as we had not yet been assured as to the rumor concerning the trouble between the miners and Indians, we felt a little apprehensive, but being able to learn nothing from them we had to put our fears aside and proceed blindly.

Between Rink Rapids and Pelly River, fifty-eight and a half miles, no streams of any importance enter the Lewes; in fact, with the exception of the Tatshun, it may be said that none at all enter.

About a mile below Little Rapids the river spreads out into a lake-like expanse, with many islands; this continues for about three miles, when it contracts to something like the usual width; but bars and small islands are very numerous all the way to Pelly River. About five miles above Pelly River there is another lake-like expanse filled with islands. The river here for three or four miles is nearly a mile wide, and so numerous and close are the islands that it is impossible to tell when floating among them where the shores of the river are. The current, too, is swift, leading one to suppose the water shallow; but I think even here a channel deep enough for such boats as will navigate this part of the river can be found. Schwatka named this group of islands "Ingersoll Islands."

At the mouth of the Pelly the Lewes is about half a mile wide, and here too there are many islands, but not in groups as at Ingersoll Islands.

About a mile below the Pelly, just at the ruins of Fort Selkirk, the Lewes was found to be 565 yards wide; about two-thirds being ten feet deep, with a current of about four and three-quarter miles per hour; the remaining third was more than half taken up by a bar, and the current between it and the south shore was very slack.

Pelly River at its mouth is about two hundred yards wide, and continues of this width as far up as could be seen. Dr. Dawson made a survey and examination of this river, which will be found in his report already cited, "Yukon District and Northern British Columbia."

Just here for a short distance the course of the Yukon-Pelly is nearly west, and on the south side, about a mile below the junction with the Lewes, stands all that remains of the only trading post ever built by white men in the district. This post was established by Robert Campbell, for the Hudson's Bay Company, in the summer of 1848. It was first built on the point of land between the two rivers, but this location proving untenable on account of flooding by ice jams in the spring, it was, in the season of 1852, moved across the river to where the ruins now stand. It appears that the houses composing the post were not finished when the Indians from the coast on Chilkat and Chilkoot Inlets came down the river to put a stop to the competitive trade which Mr. Campbell had inaugurated, and which they found to seriously interfere with their profits. Their method of trade appears to have been then pretty much as it is now—very one sided. What they found it convenient to take by force they took, and what it was convenient to pay for at their own price they paid for.

Rumors had reached the post that the coast Indians contemplated such a raid, and in consequence the native Indians in the vicinity remained about nearly all summer. Unfortunately, however, they went away for a short time, and during their absence the coast Indians arrived in the early morning, and surprised Mr. Campbell in bed. They were not at all rough with him, but gave him the privilege of leaving the place within twenty-four hours, after which he was informed that he was liable to be shot if seen by them in the locality. They then pillaged the place and set fire to it, leaving nothing but the remains of the two chimneys which are still standing. This raid and capture took place on the 1st August, 1852.

Mr. Campbell dropped down the river, and met some of the local Indians who returned with him, but the robbers had made their escape. I have heard that the local Indians wished to pursue and overtake them, but to this Mr. Campbell would not consent. Had they done so it is probable not many of the raiders would have escaped, as the superior local knowledge of the natives would have given them an advantage difficult to estimate, and the confidence and spirit derived from the aid and presence of a white man or two would be worth much in such a conflict.

Mr. Campbell went on down the river until he met the outfit for his post on its way up from Fort Yukon, which he turned back. He then ascended the Pelly, crossed to the Liard, and reached Fort Simpson, on the Mackenzie, late in October.

Mr. Campbell's first visit to the site of Fort Selkirk was made in 1840, under instructions from Sir George Simpson, then Governor of the Hudson's Bay Company. He crossed from the head waters of the Liard to the waters of the Pelly. It appears the Pelly, where he struck it, was a stream of considerable size, for he speaks of its appearance when he first saw it from "Pelly Banks," the name given the bank from which he first beheld it, as a "splendid river in the distance." In June, 1843, he descended the Pelly to its confluence with the main stream, which he named the "Lewes." Here he found many families of the native Indians—"Wood Indians," he called them. These people conveyed to him, as best they could by word and sign, the dangers that would attend a further descent of the river, representing that the country below theirs was inhabited by a tribe of fierce cannibals, who would assuredly kill and eat them This so terrified his men that he had to return by the way he came, pursued, as he afterwards learned, by the Indians, who would have murdered himself and party had they got a favorable opportunity. Thus it was not until 1850 that he could establish, what he says he all along believed, "that the Pelly and Yukon were identical." This he did by descending the river to where the Porcupine joins it, and where in 1847 Fort Yukon was established by Mr. A. H. Murray for the Hudson's Bay Company.

Mr. Campbell then named the river he had discovered and explored from the height of land to the junction with the Porcupine, "Pelly River," and had it

delineated and so named on a map of that part of the country, drawn by J. Arrowsmith, the topographer for the Hudson's Bay Company, in 1853.

With reference to the tales told him by the Indians of bad people outside of their country, I may say that Mackenzie tells pretty much the same story of the Indians on the Mackenzie when he discovered and explored that river in 1789. He had the advantage of having Indians along with him whose language was radically the same as that of the people he was coming among, and his statements are more explicit and detailed. Everywhere he came in contact with them they manifested, first, dread of himself and party, and when friendship and confidence were established they nearly always tried to detain him by representing the people in the direction he was going as unnaturally bloodthirsty and cruel, sometimes asserting the existence of monsters with supernatural powers, as at Manitou Island, a few miles below the present Fort Good Hope, and the people on a very large river far to the west of the Mackenzie, probably the Yukon, they described to him as monsters in size, power and cruelty.

In our own time, after all the intercourse that there has been between them and the whites, more than a suspicion of such unknown, cruel people lurks in the minds of many of the Indians. It would be futile for me to try to ascribe an origin for these fears, my knowledge of their language and idiosyncrasies being so limited.

Nothing more was ever done in the vicinity of Fort Selkirk by the Hudson's Bay Company after these events, and in 1869 the Company was ordered by Capt. Charles W. Raymond, who represented the United States Government, to evacuate the post at Fort Yukon, he having found that it was west of the 141st. meridian. The post was occupied by the Company, however, for some time after the receipt of this order, and until Rampart House was built, which was intended to be on British territory, and to take the trade previously done at Fort Yukon.

Under present conditions the Company cannot very well compete with the Alaska Fur Company, whose agents do the only trade in the district, and they appear to have abandoned—for the present at least—all attempt to do any trade nearer to it than Rampart House, to which point, notwithstanding the distance and difficulties in the way, many of the Indians on the Pelly-Yukon make a trip every two or three years to procure goods in exchange for their furs. The clothing and blankets brought in by the Hudson's Bay Company they claim are much better than those traded on their own river by the Americans. Those of them that I saw who had any English blankets exhibited them with pride, and exclaimed "good." They point to an American blanket in contempt, with the remark "no good," and speak of their clothing in the same way.

On many maps of Alaska a place named "Reed's House" is shown on or near the upper waters of Stewart River. I made enquiries of all whom I thought likely to know anything concerning this post, but failed to elicit any information showing that there ever had been such a place. I enquired of Mr. Reid, who was in the Company's service with Mr. Campbell at Fort Selkirk, and after whom I thought, possibly, the place had been called, but he told me he knew of no such post, but that there was a small lake at some distance, in a northerly direction, from Fort Selkirk, where fish were procured. A sort of shelter had been made at that point for the fishermen, and a few furs might have been obtained there, but it was never regarded as a trading post.

Below Fort Selkirk the Pelly-Yukon River is from five to six hundred yards broad, and maintains this width down to White River, a distance of ninety-six miles. Islands are numerous, so much so that there are very few parts of the river where there are not one or more in sight. Many of them are of considerable size, and nearly all are well timbered. Bars are also numerous, but almost all are composed of gravel, so that navigators will not have to complain of shifting sand bars. The current, as a general thing, is not so rapid as in the upper part of the river, averaging about four miles per hour. The depth in the main channel was always found to be more than six feet.

From Pelly River to within twelve miles of White River the general course of the river is a little north of west; it then turns to the north, and the general course as far as the site of Fort Reliance is due north.

White River enters the main river from the west. At the mouth it is about two hundred yards wide, but a great part of it is filled with ever-shifting sand bars, the main volume of water being confined to a channel not more than one hundred yards in width. The current is very strong, certainly not less than eight miles per hour. The color of the water bears witness to this, as it is much the muddiest that I have ever seen.

I had intended to make a survey of part of White River, as far as the International Boundary, and attempted to do so; but, after trying for over half a day, I found it would be a task of much labor and time, altogether out of proportion to the importance of the end sought, and therefore abandoned it. The valley, as far as can be seen from the mouth, runs about due west for a distance of eight miles; it then appears to bear to the south-west; it is about two miles wide where it joins the Pelly Valley, and apparently keeps the same width as far as it can be seen.

Mr. Harper, of the firm of Harper, McQuestion & Co., went up this river with sleds in the fall of 1872 a distance of fifty or sixty miles. He describes it as possessing the same general features all the way up, with much clay soil along its banks. Its general course, as sketched by him on a map of mine, is for a distance of about thirty miles a little north-west, thence south-west thirty or thirty-five miles, when it deflects to the north-west, running along the base of a high mountain ridge. If the courses given are correct it must rise somewhere near the head of Forty Mile River; and if so, its length is not at all in keeping with the volume of its discharge, when compared with the known length and discharge of other rivers in the territory. Mr. Harper mentioned an extensive flat south of the mountain range spoken of, across which many high mountain peaks could be seen. One of these he thought must be Mount St. Elias, as it overtopped all the others; but as Mount St. Elias is about one hundred and eighty miles distant his conclusion is not tenable. From his description of this mountain it must be more than twice the height of the highest peaks seen anywhere on the lower river, and consequently must be ten or twelve thousand feet above the sea. He stated that the current in the river was very swift, as far as he ascended, and the water muddy. The water from this river, though probably not a fourth of the volume of the Pelly-Yukon, discolors the water of the latter completely; and a couple of miles below the junction the whole river appears almost as dirty as White River.

Between White and Stewart Rivers, ten miles, the river spreads out to a mile and upwards in width, and is a maze of islands and bars. The survey was carried down the easterly shore, and many of the channels passed through barely afforded water enough to float the canoes. The main channel is along the westerly shore, down which the large boat went, and the crew reported plenty of water.

Stewart River enters from the east, in the middle of a wide valley, with low hills on both sides, rising on the north side in steps or terraces to distant hills of considerable height. The river, half a mile or so above the mouth, is two hundred yards in width. The current is slack and the water shallow and clear, but dark colored.

While at the mouth I was fortunate enough to meet a miner who had spent the whole of the summer of 1887 on the river and its branches prospecting and exploring. He gave me a good deal of information of which I give a summary. He is a native of New Brunswick, Alexander McDonald by name, and has spent some years mining in other places, but was very reticent about what he had made or found. Sixty or seventy miles up the Stewart a large creek enters from the south, which he called Rose Bud Creek or River, and thirty or forty miles furthur up a considerable stream flows from the north-east, which appears to be Beaver Biver, as marked on the maps of that part of the country. From the head of this stream he floated down on a raft, taking five days to do so. He estimated his progress at forty or fifty miles each day, which gives a length of from two hundred to two hundred and fifty

miles. This is probably an overestimate, unless the stream is very crooked, which he stated was not the case. As much of his time would be taken up in prospecting, I should call thirty miles or less a closer estimate of his progress. This river was from fifty to eighty yards wide and was never more than four or five feet deep, often being not more than two or three; the current, he said, was not at all swift. Above the mouth of this stream the main river is from one hundred to one hundred and thirty yards wide with an even current and clear water. Sixty or seventy miles above the last mentioned branch another large branch joins, which is possibly the main river. At the head of it he found a lake nearly thirty miles long and averaging a mile and a half in width, which he called Mayhew Lake, after one of the partners in the firm of Harper, McQuestion & Co. He explored the lake and the head of the River, but only saw the lower part of the river near its mouth.

Thirty miles or so above the forks on the other branch there are falls, which McDonald estimated to be from one to two hundred feet in height. I met several parties who had seen these falls, and they corroborate this estimate of their height. McDonald went on past the falls to the head of this branch and found terraced gravel hills to the west and north; he crossed them to the north, and found a river flowing northward. On this he embarked on a raft and floated down it for a day or two, thinking it would turn to the west and join the Stewart, but finding it still continuing north, and acquiring too much volume to be any of the branches he had seen while passing up the Stewart, he returned to the point of his departure, and after prospecting among the hills around the head of the river he started westward, crossing a high range of mountains composed principally of shales with many thin seams of what he called quartz ranging from one to six inches in thickness.

On the west side of this range he found a river flowing out of what he called Mayhew Lake, and crossing this got to the head of Beaver River, which he descended as before mentioned.

It is probable the river flowing northwards, on which he made a journey and returned, was a branch of Peel River. He described the timber on the gravel terraces of the water-shed as small and open. He was alone in this unknown wilderness all summer, not seeing even any of the natives. There are few men so constituted as to be capable of isolating themselves in such a manner. Judging from all I could learn it is probable a light-draught steamboat could navigate nearly all of Stewart River and its tributaries.

From Stewart River to the site of Fort Reliance, seventy-three and a quarter miles, the Pelly-Yukon is broad and full of islands. The average width is between a half and three-quarters of a mile, but there are many expansions where it is over a mile in breadth; however in these places it cannot be said that the waterway is wider than at other parts of the river, the islands being so large and numerous. In this reach no streams of any importance enter.

About thirteen miles below Stewart River a large valley joins that of the river, but the stream occupying it is only a large creek. This agrees in position with what has been called Sixty Mile Creek, which was supposed to be about that distance above Fort Reliance, but it does not agree with descriptions which I received of it; moreover, as Sixty Mile Creek is known to be a stream of considerable length, this creek would not answer its description.

Twenty-two and a half miles from Stewart River another and larger creek enters from the same side; it agrees with the descriptions of Sixty Mile Creek, and I have so marked it on my map. This stream is of no importance, except for what mineral wealth may be found on it.

Six and a half miles above Fort Reliance the Ton-dac River of the Indians (Deer River of Schwatka) enters from the east. It is a small river about forty yards wide at the mouth, and shallow; the water is clear and transparent, and of beautiful blue color. The Indians catch great numbers of salmon here. They had been fishing shortly before my arrival, and the river, for some distance up, was full of salmon traps.

A minor had prospected up this river for an estimated distance of forty miles, in the season of 1887. I did not see him, but got some of his information at second hand. The water being so beautifully clear I thought it must come through a large lake not far up; but as far as he had gone no lakes were seen. He said the current was comparatively slack, with an occasional "ripple" or small rapid. Where he turned back, the river is surrounded by high mountains, which were then covered with snow, which accounts for the purity and clearness of the water.

It appears that the Indians go up this stream a long distance to hunt, but I could learn nothing definite as to their statements concerning it.

Twelve and a half miles below Fort Reliance, the Chan-din-du River, as named by Schwatka, enters from the east. It is thirty to forty yards wide at the mouth, very shallow, and for half a mile up is one continuous rapid. Its valley is wide and can be seen for a long distance looking north-eastward from the mouth.

Between Fort Reliance and Forty Mile River (called Cone Hill River by Schwatka) the Lewes assumes its normal appearance, having fewer islands and being narrower, averaging four to six hundred yards wide, and the current being more regular. This stretch is forty-six miles long, but was estimated by the traders at forty, from which the Forty Mile River took its name.

Forty Mile River joins the main river from the west. Its general course as far up as the International Boundary, a distance of twenty-three miles, is south-west; after this it is reported by the miners to run nearer south. Many of them claim to have ascended this stream for more than one hundred miles, and speak of it there as quite a large river. They say that at that distance it has reached the level of the plateau, and the country adjoining it they describe as flat and swampy, rising very little above the river. It is only a short distance across to the Tanana River—a large tributary of the Yukon—which is here described as an important stream. However, only about twenty-three miles of Forty Mile River are in Canada; and the upper part of it and its relations to other rivers in the district have no direct interest for us.

Forty Mile River is one hundred to one hundred and fifty yards wide at the mouth, and the current is generally strong, with many small rapids. Eight miles up is the so called cañon; it is hardly entitled to that distinctive name, being simply a crooked contraction of the river, with steep rocky banks, and on the north side there is plenty of room to walk along the beach. At the lower end of the cañon there is a short turn and swift water in which are some large rocks; these cannot generally be seen, and there is much danger of striking them running down in a boat. At this point several miners have been drowned by their boats being upset in collision with these rocks. It is no great distance to either shore, and one would think an ordinary swimmer would have no difficulty in reaching land; but the coldness of the water soon benumbs a man completely and renders him powerless. In the summer of 1887, an Indian, from Tanana, with his family, was coming down to trade at the post at the mouth of Forty Mile River; his canoe struck on these rocks and upset, and he was thrown clear of the canoe, but the woman and children clung to it. In the rough water he lost sight of them, and concluding that they were lost, it is said, he deliberately drew his knife and cut his throat, thus perishing, while his family were hauled ashore by some miners. The chief of the band to which this Indian belonged came to the post and demanded pay for his loss, which he contended was occasioned by the traders having moved from Belle Isle to Forty Mile, thus causing them to descend this dangerous rapid, and there is little doubt that had there not been so many white men in the vicinity he would have tried to enforce his demand.

The length of this so called cañon is about a mile. Above it the river up to the boundary is generally smooth, with swift current and an occasional ripple. The amount of water discharged by this stream is considerable; but there is no prospect of navigation, it being so swift and broken by small rapids.

From Forty Mile River to the boundary the Polly-Yukon preserves the same general character as between Fort Reliance and Forty Mile, the greatest width being about half a mile and the least about a quarter.

Fifteen miles below Forty Mile River a large mass of rock stands on the east bank. This was named by Schwatka "Roquette Rock," but is known to the traders as Old Woman Rock, a similar mass of rock, on the west side of the river, being known as Old Man Rock.

The origin of these names is an Indian legend, of which the following is the version given to me by the traders:—

In remote ages there lived a powerful showman, pronounced Tshaumen by the Indians, this being the local name for what is known as medicine man among the Indians farther south and east. The Tshaumen holds a position and exercises an influence among the people he lives with, something akin to the wise men or magi of olden times in the East. In this powerful being's locality there lived a poor man who had the great misfortune to have an inveterate scold for a wife. He bore the infliction for a long time without murmuring, in hopes that she would relent, but time seemed only to increase the affliction; at length, growing weary of the unceasing torment, he complained to the Tshaumen, who comforted him and sent him home with the assurance that all would soon be well.

Shortly after this he went out to hunt, and remained away many days endeavoring to get some provisions for home use, but without avail; he returned weary and hungry, only to be met by his wife with a more than usually violent outburst of scolding. This so provoked him that he gathered all his strength and energy for one grand effort and gave her a kick that sent her clear across the river. On landing she was converted into the mass of rock which remains to this day a memorial of her viciousness and a warning to all future scolds. The metamorphosis was effected by the Tshaumen, but how the necessary force was acquired to send her across the river (here about half a mile wide), or whether the kick was administered by the Tshaumen or the husband, my narrator could not say. He was also altogether at a loss to account for conversion of the husband into the mass of rock on the west side of the river; nor can I offer any theory, unless it is that he was *petrified* by astonishment at the result.

Such legends as this would be of interest to ethnologists if they could be procured direct from the Indians, but repeated by men who have little or no knowledge of the utility of legendary lore, and less sympathy with it, they lose much of their value.

Between Forty Mile River and the boundary line no stream of any size joins the Pelly; in fact, there is only one stream, which some of the miners have named Sheep Creek, but as there is another stream farther down the river, called by the same name, I have named it Coal Creek. It is five miles below Forty Mile, and comes in from the east, and is a large creek but not at all navigable. On it some extensive coal seams were seen, which will be more fully referred to further on.

At the observatory, three miles above the boundary, a cross section of the Lewes River was measured. It was made on the 28th of November and reduced to the height at which the water stood when I reached that place. Holes were cut in the ice at intervals of 100 feet and the depth of water was measured with a pole. The measurements commenced at the easterly shore, and were as follows: at 100 feet from water's edge, depth 10·00 feet; at 200 feet, depth 16·33 feet, at 300 feet, depth 23·00 feet; at 400 feet, depth 25·00 feet; at 500 feet, depth 25·50 feet; at 600 feet, depth 21·00 feet; at 700 feet, depth, 16·55 feet; at 880 feet, depth 11·25 feet; at 900 feet, depth 6·25 feet; at 1,000 feet, depth 3·75 feet; at 1,100 feet, depth 3·50 feet; at 1,200 feet, depth 3·50 feet; at 1,300 feet, depth 3·50 feet; at 1,400 feet, depth 3·25 feet; at 1,500 feet, depth 3·75 feet; at 1,600 feet, depth 4·00 feet; at 1,700 feet, depth 5·33 feet; at 1,800 feet, depth 6·80 feet; at 1,900 feet, depth 7·00 feet; at 2,000 feet, depth 10·50 feet; at 2,100 feet, depth 10·25 feet; at 2,200 feet, depth 4·00 feet; at 2,250 feet, water's edge.

At the boundary the river is somewhat contracted, and measures only 1,280 feet across in the winter; but in summer, at ordinary water level, it would be about one hundred feet wider. Immediately below the boundary it expands to its usual width, which is about 2000 feet. The area of the cross section measured is 22,268 feet, the

sectional area of the Tes-lin-too, as determined by Dr. Dawson and already referred to, is 3,809 feet; that of the Lewes at the Tes-lin-too, from the same authority, is 3,015 feet. Had the above cross section been reduced to the level at which the water ordinarily stands during the summer months, instead of to the height at which it stood in the middle of September when it was almost at its lowest, the sectional area would have been at least 50 per cent. more, and at spring flood level about double the above area.

It is a difficult matter to determine the actual discharge at the place of the cross section, owing to the irregularity in the depth and current, the latter being in the deep channel at the east side, when I tried it in September, approximately 4·8 miles per hour; while on the bar in midstream it was not more than 2·5 miles per hour; and between the bar and the westerly shore there was very little current.

The river above this for some miles was no better for the purpose of cross section measurement. At the boundary it is narrow and clear of bars and islands for some miles, but here I did not have an opportunity to determine the rate of the current before the river froze up, and after it froze the drift ice was jammed and piled so high that it would have been an almost endless task to cut holes through it.

Taking the sectional area of the deep part alone and the rate of current above stated, and calculating by the approximate formulæ used by Dr. Dawson, as given in Trautwine's Engineer's Pocket-Book, p. 562, the discharge in cubic feet per second is 90,864, or about three times that of the Lewes and Tes-lin-too together, as determined by Dr. Dawson. The discharge of the rest of the channel would approximate only 14,000 feet—in all about 105,000 feet. At summer level with an increased sectional area and current it would approximate 60 per cent more, or close to 170,000 feet per second. At high water level it would at least be eight to ten feet deeper, and we can only conjecture what the current would be, but I think it is safe to assume at least 80 per cent. more discharge, which would give us roughly 300,000 feet per second. For the sake of comparison, I give the discharge of the St. Lawrence and Ottawa Rivers, being the mean of the years 1867 to 1882: St. Lawrence, mean 900,000 feet; Ottawa, at Grenville, mean 85,000 feet. The point where cross section was measured is less than seven hundred miles from the head of Lewes River, and from the head of the Tes-lin-too probably eight hundred.

The current, from the boundary down to the confluence with the Porcupine, is said to be strong, and much the same as that above; from the Porcupine down for a distance of five or six hundred miles it is called medium, and the remainder easy.

On the 22nd September a small steamboat named the "New Racket" passed my camp on her way up to Forty Mile River with supplies; she was about forty feet long and nine or ten feet beam, with about two feet draught. The boat was wholly taken up with engine and boiler, the berths for the crew being over the engine room. The propelling power was a stern wheel driven by two engines of large size for such a small boat. It was claimed for her by her Captain, A. Mayhew, of the firm of Harper, McQuestion & Co., that she could make ten miles an hour in dead water. She was then twenty-two days out from St. Michel's Island, near the mouth of the river. Mr. Mayhew claimed that this was longer than usual, on account of the boiler tubes being out of order and leaking badly, so that it was impossible to keep more than fifty pounds pressure, while that generally used was about double. That this was true was apparent from the fact that it took her about five hours to make four miles; and at one place below my camp, she hung for over an hour without making any progress at all, nor could she pass that point until she stopped and bottled up steam.

After reaching Forty Mile River this boat started up the stream to Stewart River, with supplies for the few miners who intended to winter there, and materials for the Indian fur trade. Some miners, who intended to spend the summer of 1888 mining on Stewart River, took passage up on her; but after trying for nearly two days it was found impossible, loaded as she was, to make any headway, so she returned, discharged her passengers, and finally reached Stewart River light. Here the owners intended to lay her up and give her a thorough overhauling before the commencement of next season's navigation. Three other steamboats which navigate

the river, the "Yukon," the "St. Michel," and the "Explorer," belong to the Alaska Commercial and Fur Trading Company. These boats are small, and carry little or no freight themselves, but tow loaded barges. Their space is entirely devoted to engine and boiler, and they are driven by a stern wheel. Messrs Harper, McQuestion & Co., expected the Alaska Commercial and Fur Trading Company to put a larger boat on the river in the season of 1888; one that would carry one hundred and twenty to two hundred tons of freight, and make five to seven miles per hour up stream on the upper river. The other boats do not make more than three or four miles per hour, and often not that. None of these boats had passed Stewart River while I was there, nor is it probable they have since done so.

From Stewart River to the mouth of the Yukon is about 1,650 miles, and the only difficult place in all this distance is the part near the confluence with the Porcupine, which has evidently been a lake in past ages, but is now filled with islands; it is said that the current here is swift, and the channels generally narrow, rendering navigation difficult.

During my stay at the boundary, readings of the barometer were taken twice daily—at 7:30 a.m. and at 1:30 p.m. These readings are complete for the months of October, November, and December, 1887, and January and February, 1888. I have obtained from Mr. Carpmael, the director of the Meteorological Service, the readings for the same months at Victoria, B.C., Fort Simpson, B.C., and Sitka, Alaska. The readings at Victoria were taken at 8 a.m. and 2 p.m. those at Fort Simpson at 7 a.m. and 2 p.m., and those at Sitka are given as the daily mean. I took no observation to determine the humidity of the atmosphere; consequently in deducing the height of my station above sea level the correction due to the difference in tension of the vapor in the atmosphere at the different places will have to be neglected. Even had we all the data used in determining the differences of height from the differences of the barometer readings, it would be little more than a waste of time to employ it in this case, the distances between the stations being so great. The distance between Sitka and the boundary is about 560 miles in an air line, with a difference of latitude of nearly $7\frac{3}{4}$ degrees; Fort Simpson is distant about 760 miles in an air line, with a difference of latitude of 10 degrees. The difference in time between Sitka and the boundary is about twenty-three minutes, and between the boundary and Fort Simpson forty-two minutes. The readings at the latter place were therefore taken in the morning sixty-five minutes before mine and in the afternoon twelve minutes before.

The temperature of the attached thermometer was recorded with every barometer reading, but the barometer readings were not corrected for temperature, but entered as read, which will suit every purpose as well. I have used the mean of the barometer readings for the month at each of the two daily observations, corrected for the mean of the temperature readings observed at the same time, and in comparing with Sitka I have used the mean of the two daily readings.

Victoria is distant about 1,240 miles in an air line, with a difference of latitude of $16\frac{1}{3}$ degrees, and a difference in time of about an hour and ten minutes: the value of a height deduced from differences of barometer readings at this distance and extending only over a few months will not be of any definite value. Even the closest of the points, Sitka, will not under the circumstances give more than a poor approximation, but as they are the best—in fact the only measures we have at the place—they have to be accepted. Using this determination, and the known height of Bennet Lake above the sea, I have interpolated for the heights of the several points of interest along the river.

Taking the height due to difference of barometer reading alone, and neglecting all the other terms in the formula employed, the heights deduced from the mean of each month compared with each of the above places would stand as follows:—

	Sitka.	Fort Simpson.	Victoria.
	ft.	ft.	ft.
October	864	1,045	1,198
November	843	836	1,061
December	525	610	751
January	224	561	607
February	928	845	1,056
Mean	677	779	934

My readings have been corrected for the monthly mean reading of the attached thermometer, but not for capillarity, as I had no corrections furnished for that error, and I do not know what the bore of the tube was, as unfortunately it was broken before I could get it home. However, as it was large—apparently about half an inch in diameter—this source of error would not effect the result more than 10 or 12 feet.

These values show the unreliability of barometric measurements of heights when the points are so far apart and the observations extend only over short intervals of time.

One of my thermometers was broken soon after starting, and I had no means of determining the relative humidity of the air, but at my station this was not material during the term of my observations, the temperature being so low. The mean minimum for October was 18°·5; for November—5°·1; for December—33°·6, mean for 1.30 p.m.—27°·6; for January,—25°·3, for 1.30 p.m.—15°·3; for February, —16°·8, for 1.30 p.m.—4°·3.

The means of the two readings at Fort Simpson and Victoria and the mean readings at Sitka, with the means of the readings at my station corrected for temperature, stand as follows in their order for the months mentioned:—

	Victoria.	Fort Simpson.	Sitka.	Boundary.
October	30·152	29·984	29·777	28·813
November	30·024	29·835	29·812	28·865
December	29·911	29·737	29·661	29·058
January	29·975	29·933	29·546	29·296
February	30·133	29·876	29·987	28·943

From these it would appear that the reading for the month of January was abnormally high at my station; rejecting it, the mean of the other four months compared with Sitka is 790 feet. The mean of the three comparisons is 797 feet.

As Sitka is much the nearest point, the temperatures will be correspondingly nearer those of my station, and the hygrometric conditions nearer to mine than at the other places referred to. I have therefore adopted the mean of the four months —October, November, December and February—which, compared with Sitka, gives 790 feet.

The height of the confluence of Yukon and Porcupine Rivers is marked on the manuscript map furnished for my guidance as 412 feet above the sea. It is not stated who is the authority for this; but, presumably, it is Capt. C. W. Raymond, of the United States Corps of Engineers, who spent some time there in the summer of 1869. As this point is twelve or thirteen hundred miles by the river from the sea, and for more than half of the distance the current is said to be pretty strong, it is not probable that the altitude is less than this. Assuming it as 412 feet, we have a fall of 378 feet between the boundary and that point; the distance between them is about 200 miles, which gives a fall of 1·9 feet per mile in that part of the river.

As already stated, the height of the summit of Taiya Pass is 3,378 feet above the head of canoe navigation on Taiya River, and the latter is assumed to be 120 feet above the sea, making the summit 3,498 feet above tide water. The summit is 1,354 feet above Lake Lyndeman, which gives 2,144 feet for the altitude of this lake.

Between it and Lake Bennet there is a fall of 12 or 14 feet. This gives the altitude of Lake Bennet as 2,130 feet, which must be within a very few feet of the exact height.

The corrected distance from the head of Lake Bennet to the boundary is 639·5 miles. Of this 95·4 miles is lake, leaving 544·1 miles of river. Of this 2·7 miles is the cañon and its rapids, in which there is a fall of 32 feet. Excluding this we have 541·4 miles of river, with a fall of 1,308 feet.

Assuming the rate of descent to be uniform in this distance we have a fall of 2·41 feet per mile. The rate of descent is, of course, not uniform, but the error in the height of any place, deduced from its distance with this rate of fall, will not be very great.

Proceeding thus we get the altitude of Marsh or Mud Lake, 2,118 feet; the head of the cañon, 2,056 feet; the foot of the cañon, 2,024 feet; the mouth of Tahk-heena River, 1,990 feet; Lake Labarge, 1,950 feet; Tes-lin-too River, 1,873 feet; Big Salmon River, 1,787 feet; Little Salmon River, 1,700 feet; Rink Rapids, 1,556 feet; Pelly River, 1,425 feet; White River, 1,194 feet; Stewart River, 1,170 feet; Fort Reliance, 993 feet; Forty Mile River, 882 feet.

AGRICULTURAL CAPABILITIES OF THE PELLY-YUKON BASIN.

The agricultural capabilities of the country along the river are not great, nor is the land which can be seen from the river of good quality.

When we consider further the unsuitable climatic conditions which prevail in the region it may be said that as an agricultural district this portion of the country will never be of value.

My meteorological records show over eight degrees of frost on the 1st of August, over ten on the 3rd, and four times during the month the minimum temperature was below freezing. On the 13th September the minimum temperature was 16°, and all the minimum readings for the remainder of the month were below freezing.

Along the east side of Lake Bennet, opposite the Chilkoot or western arm, there are some flats of dry gravelly soil, which would make a few farms of limited extent. On the west side, around the mouth of Wheaton River, there is an extensive flat of sand and gravel, covered with small pine and spruce of stunted growth. The vegetation is poor and sparse, not at all what one would desire to see on a place upon which he was thinking of settling. At the lower end of the lake there is another extensive flat of sandy soil, thinly clad with small poplars and pines. The same remarks apply to this flat as to that at Wheaton River.

Along the westerly shore of Tagish Lake there is a large extent of low, swampy flats, a part of which might be used for the production of such roots and cereals as the climate would permit. Along the west side of Marsh Lake there is also much flat surface of the same general character, on which I saw some coarse grass which would serve as food for cattle. Along the east side the surface appeared higher and terraced, and is probably less suited to the requirements of the agriculturalist. Along the head of the river, for some miles below Marsh Lake, there are flats on both sides, which would, as far as surface conformation goes, serve for farms. The soil is of much better quality than any heretofore seen, as is proved by the larger and thicker growth of timber and underbrush which it supports. The soil bears less the character of detritus, and more that of alluvium, than that seen above.

As we approach the cañon the banks become higher and the bottom lands narrower, with some escarpments along the river. At the cañon the bank on the west side rises two hundred feet and upwards above the river, and the soil is light and sandy. On the east side of the bank is not so high, but the soil is of the same character, and the timber small and poor, being nearly all stunted pine.

Between the cañon and Lake Labarge, as far as seen from the river, there is not much land of value. The banks are generally high, and the soil light and sandy. At the head of the lake there is an extensive flat, partly covered with timber, much

larger and better than any seen above this point. Poplar eight and ten inches in diameter were not uncommon, and some spruce of fifteen and sixteen inches, and many of upwards of a foot in diameter, were also noticed. The soil, however, is light, and the vegetation, especially the grass, thin and poor.

Some miles down the lake an extensive valley joins that of the lake on the west side. This valley contains a small stream. Around this place there is some land that might be useful, as the grass and vegetation is much better than any seen so far.

On the lower end of the lake, on the west side, there is also a considerable plain which might be utilized; the soil in parts of it is good. I saw one part where the timber had been burned some time ago; here, both the soil and vegetation were good, and two or three of the plants seen are common in this part of Ontario, but they had not the vigorous appearance which the same plants have here.

Northward from the end of the lake there is a deep, wide valley, which Dr. Dawson has named "Ogilvie Valley." In this the mixed timber, poplar and spruce, is of a size which betokens a fair soil; the herbage, too, is more than usually rich for this region. This valley is extensive, and, if ever required as an aid in the sustenance of our people, will figure largely in the district's agricultural assets.

Below the lake the valley of the river is not as a rule wide, and the banks are often steep and high. There are, however, many flats of moderate extent along the river, and at its confluence with other streams. The soil of many of these is fair.

About forty miles above the mouth of the Pelly River there is an extensive flat on both sides of the Lewes. The soil here is poor and sandy, with small open timber. At Pelly River, there is a flat of considerable extent on which the ruins of Fort Selkirk stand. It is covered with a small growth of poplar and a few spruce. The soil is a gravelly loam of about eight inches in depth, the subsoil being gravel, evidently detritus. This flat extends up the river for some miles, but is all covered thickly with timber, except a small piece around the site of the fort.

On the east side of the river there is also a large plateau, but it is two or three hundred feet above the river, and the soil appears to be poor, judging from the thinness and smallness of the trees. This plateau seems to extend up the Pelly for some distance, and down the Yukon for ten or twelve miles. As seen from the river, it reminds one of the slopes and hills around Kamloops in British Columbia, and like them, though not well suited to agriculture, might yield fair pasturage should such ever be required.

A serious objection to it, however, for that purpose, if it is not watered on the surface by ponds, is that the river is difficult of access, as the plateau on the side towards the river is bounded by a perpendicular basalt cliff, which, without artificial arrangement, would completely bar approach to the water. This cliff is more than two hundred feet high at the confluence, and becomes lower as we descend the river until, at the lower end, it is not more than sixty to eighty feet high.

Between Pelly and White Rivers there are no flats of any extent. At White River there is a flat of several thousand acres, but it is all timbered, and the surface of the soil is covered with a thick growth of moss, which prevents the frost ever leaving the ground. This has so preserved fallen timber and the foliage of the trees that much of it is lying on the surface nearly as sound as when it fell. On this account the vegetable mould on the gravel is thin and poor. The standing timber also bears witness to the coldness of the soil by its slow and generally small growth. A few trees near the bank, where the sun can heat the soil, are of fair size, but further back they are generally small.

At Stewart River there is another large flat to which the same general remarks are applicable. Thence, to the site at Fort Reliance, there are no flats of any importance. High above the river in some places there are extensive wooded sloops, which, when cleared, would be well suited for such agricultural purposes as the climate would permit.

At Fort Reliance there is a flat of probably 1,500 acres in extent; but although Messrs. Harper & McQuestion lived there for some years, it appears they never made any agricultural experiments, believing that they would be futile.

At Forty Mile River there is a flat of about four or five hundred acres in area, on which the soil is of better quality than on many of the other places mentioned. On this Messrs. Harper & McQuestion have erected their dwelling and store houses. They gave it as their opinion that only very hardy roots would live through the many cold nights of the summer months, and that the season is so short that even if they survived the cold they would not attain a size fit for use.

The river is not generally clear of ice until between the 25th of May and the 1st of June, and heavy frosts occur early in September, and sometimes earlier.

At the boundary there are two flats of several hundred acres each, one on the west side, the other three miles above it on the east side. Both of these are covered with poplar, spruce, and white birch, also some willow and small pine.

In making preparations for the foundations of our house at our winter quarters near the boundary we had to excavate in the bank of the river, and in an exposed place where the sun's rays could reach the surface without hindrance from trees or other shade we found the depth to the perpetually frozen ground to be not more than two feet. In the woods where the ground was covered with over a foot of moss the frozen ground is immediately below the moss. On this the timber is generally small, and of very slow growth, as is evident from the number of annual rings of growth. I have seen trees of only three or four inches in diameter which were upwards of one hundred and fifty years old.

It is difficult to form an estimate of the total area of agricultural land seen, but it certainly bears a very small proportion to the remainder of the country. I think ten townships, or 360 square miles, would be a very liberal estimate for all the places mentioned. This gives us 230.400 acres, or, say 1,000 farms. The available land on the affluents of the river would probably double this, or give 2,000 farms in that part of our territory, but on the most of these the returns would be meagre.

Without the discovery and development of large mineral wealth it is not likely that the slender agricultural resources of the region will ever attract attention, at least until the better parts of our territories are crowded.

In the event of such discovery some of the land might be used for the production of vegetable food for the miners; but, even in that case, with the transport facilities which the district commands, it is very doubtful if it could compete profitably with the south and east.

TIMBER FOR USE IN BUILDING AND MANUFACTURING.

The amount of this class of timber in the district along the river is not at all important. There is a large extent of forest which would yield firewood, and timber for use in mines, but for the manufacture of lumber there is very little.

To give an idea of its scarceness, I may state that two of my party made a thorough search of all the timbered land around the head of Lake Bennet and down the lake for over ten miles, and in all this search only one tree was found suitable for making such plank as we required for the construction of our large boat. This tree made four planks 15 inches wide at the butt, 7 at the top, and 31 feet long.

Such other planks as we wanted had to be cut out of short logs, of which some, 10 to 14 inches in diameter and 10 to 16 feet long, could be found at long intervals. The boat required only 450 feet of plank for its construction, yet some of the logs had to be carried nearly 200 yards, and two saw-pits had to be made before that quantity was procured, and this on ground that was all thickly wooded with spruce, pine, and some balsam, the latter being generally the largest and cleanest-trunked.

These remarks apply to the timber until we reach the lower end of Marsh Lake. On the head of the river, near the lake, some trees of fair size, 12 to 14 inches in diameter, and carrying their thickness very well, could be got, but their number was small, and they were much scattered.

At the cañon the timber is small and scrubby; below it there were a few trees that would yield planks from 7 to 10 inches wide, but they have been nearly all cut by the miners, many of whom made rafts at the head of Lake Bennet, floated

down to White Horse Rapids, and there abandoned them for boats which they then built.

The great bulk of the timber in the district suitable for manufacture into lumber is to be found on the islands in the river. On them the soil is warmer and richer, the sun's rays striking the surface for a much longer time and more directly than on the banks.

At the confluence with the Pelly, on the east side of the river, there is a grove of spruce, from which some very nice lumber could be made, and on the islands below this much of the same class of timber exists. Near White and Stewart Rivers there is a good deal of nice clean timber, but it is small. It is said there is more good timber on Stewart River in proportion to the ground wooded than on the main river.

Between Stewart River and the boundary there is not so much surface covered with large trees as on many of the flats above it, the valley being generally narrower, and the sides steeper than higher up the river. This, of course, precludes the growth of timber.

To estimate the quantity of timber in the vicinity of the river in our territory would be an impossible task, having only such data as I was able to collect on my way down. I would, however, say that one-fourth of the area I have given as agricultural land would be a fair conjecture. This would give us two and a half townships, or ninety square miles, of fairly well timbered ground; but it must be borne in mind that there is not more than a square mile or so of that in any one place, and most of the timber would be small and poor compared with the timber of Manitoba and the easterly part of the North-West Territories.

At the Boundary Line I required, as has already been explained, a tree 22 inches in diameter at the ground on which to erect my transit. An exhaustive search of over three square miles of the woods there, though showing many trees of convenient size for house logs, and many for small clean planks, showed only one 18 inches in diameter at a distance of 5 feet above the ground.

It may be said that the country might furnish much timber, which, though not fit to be classed as merchantable, would meet many of the requirements of the only industry the country is ever likely to have, viz., mining.

MINERALS.

Under this head I will first mention coal. A thin seam of this was found on Lewes River, about six miles above Five Finger Rapids. This seam was about 3 feet thick, and at that stage of water was 8 or 10 feet above the river. It could be traced for several hundred yards along the bank. Dr. Dawson made an examination of this seam, and I quote from his report regarding it: "This exposure includes, within 60 feet of the base of the bluff, at least three coal beds, of which the lowest is about 3 feet thick. This and the other beds contain some good looking coal, of which a thickness of about a foot sometimes occurs, but the greater part of the material is so sandy and impure as to be useless. The coal has been examined by Mr. G. C. Hoffman, who describes it as a lignite coal, with the following composition:—

Hygroscopic water	6·03
Volatile combustible matter	36·92
Fixed Carbon	49·03
Ash	8·02
	100·00

Six miles below Five Finger Rapids—at Little Rapids—thin seams of coal were seen in some shale on the east bank of the river. They were unimportant, being only an inch or so thick, but they show a probable continuation of the first mentioned bed, and a likelihood that a search would reveal an exposure of some value.

No other trace of coal was seen until Coal Creek, five miles below Forty Mile River, was reached. In the drift at the mouth of this creek I picked up specimens of coal much weathered and worn. I made inquiries of the Indians in the vicinity, but they manifested surprise at my showing it to them and burning some of it before them. They professed entire ignorance of the existence of any such stuff up the creek, and said they had never seen or heard of it, though they must, however, have seen it at Belle Isle, near which place there is some on a creek that comes in from the west. Some of this Messrs. Harper & McQuestion had brought to the post, and burned there, and they had also sent some to San Francisco to be tested.

I made enquiries of the miners and of Mr. Harper, but found that none of them had any personal knowledge of the location of the seam. It appeared, however, that an old man, who had gone out of the country in the fall, had spent part of the summer prospecting on the creek, and though he found no gold he reported abundance of coal, but gave no further particulars. I had several conversations with some of the miners about this coal, and was fortunate enough to enlist the interest of one of them, Mr. James McAuley, of Victoria, B.C. He promised he would some time during the ensuing summer or fall go up the creek and try to find the seam or seams, and communicate the result to me at the first opportunity. This promise he has kept, and in a letter dated at Port Townsend, W.T., 22nd October, 1888, he says:

"I have measured those coal ledges that you desired I should examine in the British possessions. I brought some samples as far as St. Michel's, but they were mislaid. Two of the ledges measure 5 feet and one 7, and there are others much larger, but I did not have time to examine them."

That is all he says with reference to the coal seams. Although it is not as definite as one would wish, enough is stated to show that there is a large quantity of coal on the creek. He does not say what distance it is up the creek, but the reason for this is plain. When I asked him to make the search he demurred, on the ground that I would publish his reply, and that some one with capital and influence might benefit by his discovery. I told him that if I published his discovery I would give him credit for it, and that he need not be definite in his location, as all that I wished to ascertain was as to the quantity of coal; and on this understanding he consented to make the search.

No other indications of coal were seen in that part of the country. Some of the drift specimens I picked up at the mouth of the creek were sent out for examination; but when they reached Ottawa they were almost reduced to powder, and I have heard nothing of any attempt at assay being made.

METALS FOUND ON THE RIVER.

About two miles up Forty Mile River there are large exposures of a white and a grey limestone, containing many thin seams and pockets of galena. One of the seams as seen on the bank is of considerable extent, but as to its length there is no evidence, as it is all covered with drift. Two specimens were sent out and have been assayed by Mr. G. C. Hoffman, of the Geological Survey, with the following result: Specimen marked II, from Forty Mile, about two and a half miles up, contains: gold, a distinct trace; silver, $38\frac{64}{100}$ ounces to the ton of 2,000 pounds.

Specimen marked III, from exposure on Forty Mile River, about three-quarters of a mile up, contains neither gold nor silver.

Were these seams properly surveyed the former might be found of sufficient extent and value to warrant development.

Specimen marked I, from north bank of Pelly-Yukon River opposite the mouth of Tondac River, about five miles above Fort Reliance, contains: gold, a trace; silver, $3\frac{64}{100}$ ounces to the ton.

Mr. Harper told me he had sent out specimens of the latter ore to San Francisco some years ago, for assay, and that it was pronounced good, but he could not give the value. I did not make an examination of the seam, but it appeared to be extensive. It is of bluish color on the surface, and earthy in appearance.

Specimen marked IIII, from near Station 634 of survey, or near Chan-din-du River, ten or twelve miles below Fort Reliance, contains: gold, a trace; silver, 0·117 ounces to the ton. Nothing was observed at this point to indicate an extensive quantity of this ore.

It must be borne in mind that these specimes were found by accident. A closer examination of the localities might reveal valuable seams. I have described the specimens found in the order of their value. Though none of them are rich, they show that through an extensive district there are at least indications of wealth. The order in which they were picked up on the river is, I, IIII, and II, and III together on Forty Mile River. From I to III is about forty miles in an air line. I was informed that gold and silver bearing specimens of quartz had been found on Sixty Mile Creek, but I can give no details. I was also informed that a specimen of gold-bearing quartz was picked up some years ago, high up on the side of the bank of Lewes River, opposite the mouth of White River. It was sent to San Francisco and assayed, showing the enormous value of $20,000 to the ton. This specimen was picked up above high water mark, so that it must have been found at or near its origin, or have been transported there by a glacier, the bank being about 1,200 feet high. No further details regarding this specimen could be learned.

An extensive ledge of gold-bearing quartz is reported on the westerly side of the river, about two miles above Stewart River, but regarding it I could learn nothing definite. It may be a continuation of the same ledge which yielded the foregoing specimen.

While on Lake Bennet building our boat I found an extensive ledge of quartz, and sent specimens of it out by Dr. Dawson. The assay showed that they contained only traces of gold. The ledge is 60 to 80 feet wide, and can be easily traced on the surface for three or four miles. A small creek cuts through it about a mile from the lake, and in this creek are found colors of gold.

While we were working at our boat an expert, employed by some California capitalists, came in with an old man who had made a descent of the river the previous summer. The old man and his party were storm-staid on what he called Lake Bennet, and while so delayed he found an enormous exposure of what he thought was gold-bearing rock. He took out specimens of it, and had them assayed at San Francisco. The result was so promising ($8.80 of gold, and 92 cents of silver to the ton) that he enlisted the interest of some capitalists who sent him out with the expert to locate and test it thoroughly. The old man described the exposure so minutely and circumstantially that one could scarcely disbelieve his statement. They looked for the ledge for some days, but could find nothing resembling what he described. They then called upon me and requested my aid. As I was making all possible haste to keep my appointment with Dr. Dawson at Pelly River I was loath to lose time in aiding the search, but, on account of the importance of the matter, and the old man's earnestness and importunity, and influenced further by a certificate of assay which he had, showing the specimens to have yielded the amounts stated (about equal to the celebrated Treadwell mine at Juneau, Alaska, the rock of which he said his mine much resembled), I at last consented.

I spent a day and night searching with him and his associates, but we failed to find anything like what he described. The old man told so many conflicting stories, and seemed to know so little of the lake, that I became convinced he was astray, and had been hoaxed by some one with a piece of the Treadwell rock. I then left them to shift for themselves. The expert took the same view of the matter, and, as he was in charge of the search, ended it there.

I afterwards, on Tagish Lake, saw a place much resembling that described. It is on the south side of the lake, and just east of its junction with the Takone arm. I was strongly of opinion that this is the place he referred to, and would have examined it to verify my impression, but the wind was too strong and the lake too rough to allow of crossing over.

These are all the indications of ore *in situ* which I saw or heard of.

The gold heretofore found and worked in the district has been all placer gold. Search was made for it occasionally by us along the lakes and river as we descended, but, with the exception of the colors mentioned at the quartz ledge on Lake Bennet, none was found until after we had passed Lake Labarge, about six miles below which, at a sharp, short bend in the river, we found in a bar many colors to the pan. It may be said generally that colors are found anywhere on the river between that point and the boundary, and also on all the tributaries which have been prospected.

It is probable that we have not less than 1,400 miles of stream in our part of the district, upon all of which gold can be found.

About eighteen miles below the Tes-lin-too I saw the first place that had been worked for gold. Here a hut had been erected, and there were indications that a party had wintered there. Between it and Big Salmon River six other locations were met with. One of them, named Cassiar Bar, was worked in the season of 1886, by a party of four, who took out $6,000 in thirty days. They were working there when I passed in 1887, but stated that all they could get that season was about $10 per day, and that it was then (3rd August) about worked out. At the time of my visit they were trying the bank, but found the ground frozen at a depth of about three feet, though there was no timber or moss on it. They had recourse to fire to thaw out the ground, but found this slow work.

Two of this party subsequently went down to Forty Mile River, where I met one of them. He was a Swede, and had been gold mining for upwards of twenty-five years in California and British Columbia. He gave me his opinion on the district in these words: "I never saw a country where there was so much gold, and so evenly distributed; no place is very rich, but no place is very poor; every man can make a "grub stake" (that is enough to feed and clothe him for a year), which is more than I can say of the other places I have been in."

In conversation with Mr. T. Boswell, who, as already stated, had prospected the Tes-lin-too, or Newberry River, in the summer of 1887, I learned that the whole length of that river yielded fine gold, generally at the rate of $8 to $10 per day; but as the miners' great desideratum is coarse gold, they do not remain long in a country in which the fine gold only is found—generally no longer than is necessary to make a "grub stake," unless the gold is in unusually large quantities. Mr. Boswell therefore went to the lower part of the river, having heard the reports of rich finds.

Stewart River was the first in the district on which mining to any extent was done. In 1886 there were quite a number of miners on it engaged in washing gold, and they all appear to have done fairly well. Their exact number I could not ascertain.

I may say that it is generally very difficult to get any exact, or even approximately exact, statement of facts or values from miners. Many of them are inveterate jokers, and take delight in hoaxing; the higher the official or social position of the person they hoax the better they are pleased. I have several times found that after spending hours getting information from one of them it would be all contradicted by the next one I met. Another cause of difficulty in getting trustworthy information from them is that, in a certain sense, they consider every Government official or agent their enemy, and that he is in the country to spy upon their doings, and find out their earnings, which latter the great majority of them are very averse to have known.

So far as I could see or learn, they do not even disclose to each other their earnings for the season. I met one or two who told me that they had made a certain amount in the season, but on enquiry among the rest, these statements were ridiculed and declared untrue. As a rule, they are very generous and honest in their dealings with their fellow men, but a desire for correct geographical or statistical knowledge does not actuate very many of them: hence the disagreement and often contradiction in their statements.

I have heard the amount of gold taken from off Stewart River in 1885 and 1886 estimated at various amounts. One estimate was $300,000, but this must be excessive. The highest amount I heard as representing one man's earnings was about $6,000. This may be true, as many agree that $30 per day, per man, was common

on many of the bars on the river, and instances of as high as $100 per day having been earned were spoken of.

The only mining done on Stewart River was on the bars in the river; the bench and bank bars were all timbered and frozen, so that to work them would entail a resort to hyraulic mining, for which there was no machinery in the country.

During the fall of 1886, three or four miners combined and got the owners of the "New Racket" steamboat to allow the use of her engines to work pumps for sluicing with. The boat was hauled up on a bar, her engines detached from the wheels, and made to drive a set of pumps manufactured on the ground, which supplied water for a set of sluicing boxes. With this crude machinery in less than a month the miners cleared $1,000 each, and paid an equal amount to the owners of the boat as their share.

Alexander McDonald, who has been mentioned before, reported to me that the gold on the upper river was somewhat coarser than that on the lower, but not enough so as to be called "coarse gold." He seemed to be satisfied with the result of his season's prospecting, and intended spending the next season there.

Many of the miners who had spent 1886 on Stewart River and 1887 on Forty Mile River, seemed to think the former the better all round mining field, as there were no such failures there as on Forty Mile, and they declared their intention to make their way back to the Stewart for the season of 1888.

Forty Mile River is the only river in the district on which, up to the fall of 1888, coarse gold had been found, and it may be said that much of it can hardly claim that distinctive title. The largest nugget found was worth about $39. It was lost on the body of a miner who was drowned at the cañon. Several other nuggets of much less value have been found, but the number of pieces which one could call "nugget" are few.

The miners term Forty Mile a "bed-rock" creek—that is, one in the bed of which there is little or no drift, or detrital matter, the bottom of the river being bed-rock. In many places this rock has been scraped with knives by the miners, in order to gather the small amount of detritus and its accompanying gold.

Very little of the gold on this creek was found in Canadian territory, the coarsest gold being found well up the river. The river had been prospected in 1887 for upwards of one hundred miles, and gold found all the way up. The great point with a miner is to find where the gold comes from. To do this he has to reach a point on the river where there is none; then he knows he has passed the source, and will search in side valleys and gulches. The theory seems to be that the gold is stored up somewhere and dribbled out along the river.

Pieces of gold-bearing quarts had frequently been picked up along the river in the shallow drift, but none had been found in place, nor did it appear to me that much search had been made for it. Near the mouth of the river there is an extensive flat of detrital matter through which a couple of small creeks flow. This is all said to be gold-bearing, and, it was thought, would pay well for sluicing. Accordingly, a couple of claimants had staked off claims at the mouth of the creeks, and intended to try sluicing in the season of 1888. I have not heard how the venture succeeded.

During the season of 1887 some miners prospected Pelly River, but I have no information as to their success. Dr. Dawson mentions the fact of their being there, but does not appear to have got any statistics from them.

Big and Little Salmon Rivers have also been prospected, with the usual result that more or less gold has been found everywhere.

I think it may, with confidence, be asserted that rich finds will yet be made of both coarse gold and gold-bearing quartz. It is not likely in the nature of things that such a vast extent of country should have all its fine gold deposited as sediment, brought from a distance, in past ages of the world's development. If this is not the case, the matrix, from which all the gold on these streams has come, must still exist, in part at least, and will no doubt be discovered, and thus enrich this otherwise gloomy and desolate region.

There are many bank and bench bars along the river which would pay well if sluiced, but there is no convenient or economical way of getting water on them, and there is no pumping machinery as yet in the country. One bank bar of large extent, called Rogers' Bar, just below Old Man Rock, attracted attention in the spring of 1888, and some miners were thinking of getting in an engine and pumps to work it. I made an estimate of the size of engine required for their needs, and computed the probable cost of the plant laid down, but it does not appear that they made any further move.

This bar is more than fifty feet above the water. It fronts on the river for more than two miles, and is in places nearly two miles deep. It is believed that in past ages the Old Man and Old Woman rocks were connected, and formed a barrier across the river over which there was a cataract. Below this the fine gold remained, while the sand and gravel were in part carried further down. So impressed were some persons with the prospect of rich finds on this bar that they thought of bringing water across from the high level of Forty Mile River, a distance of over thirty miles; but when I went up Forty Mile River to the boundary I saw that it could not be done without the aid of force pumps, and I explained this drawback to them. This bar is said to yield four to six cents to the pan, which, with plenty of water for sluicing, would pay well, while its large extent would warrant considerable outlay. Doubtless there are many other bars as rich as this one, though not as large.

Platinum is generally found associated with gold. This is particularly the case on Forty Mile River.

As very few outside of mining communities understand anything of the nomenclature of the craft, or of the methods employed to separate the very small quantities of the precious metal from the baser material with which it is associated, a short description will not be out of place.

When a miner "utilizes" a [illegible] "prospects" it by washing a few panfuls of the gravel or sand of which it is composed. According to the number of "colors" he finds to the pan, that is, the number of specks of gold he can see in his pan, after all the dirt has been washed out, he judges of its richness. Many of them have so much experience that they can tell in a few minutes, very nearly, how much a bar will yield per day to the man.

The process of "placer" mining is about as follows: After clearing all the coarse gravel and stone off a patch of ground, the miner lifts a little of the finer gravel or sand in his pan, which is a broad, shallow dish, made of strong sheet iron; he then puts in water enough to fill the pan, and gives it a few rapid whirls and shakes; this tends to bring the gold to the bottom on account of its greater specific gravity. The dish is then shaken and held in such a way that the gravel and sand are gradually washed out, care being taken as the process nears completion to avoid letting out the finer and heavier parts that have settled to the bottom. Finally all that is left in the pan is whatever gold may have been in the dish and some black sand which almost invariably accompanies it.

This black sand is nothing but pulverised magnetic iron ore. Should the gold thus found be fine, the contents of the pan are thrown into a barrel containing water and a pound or two of mercury. As soon as the gold comes in contact with the mercury it combines with it and forms an amalgam. The process is continued until enough amalgam has been formed to pay for "roasting" or "firing." It is then squeezed through a buckskin bag, all the mercury that comes through the bag being put back into the barrel to serve again, and what remains in the bag is placed in a retort, if the miner has one, or, if not, on a shovel, and heated until nearly all the mercury is vaporized. The gold then remains in a lump with some mercury still held in combination with it.

This is called the "pan" or "hand" method, and is never, on account of its slowness and laboriousness, continued for any length of time when it is possible to procure a "rocker," or to make and work sluices.

A "rocker" is simply a box about three feet long and two wide, made in two parts, the top part being shallow, with a heavy sheet iron bottom, which is punched

full of quarter-inch holes. The other part of the box is fitted with an inclined shelf about midway in its depth, which is six or eight inches lower at its lower end than at its upper. Over this is placed a piece of heavy woollen blanket. The whole is then mounted on two rockers, much resembling those of an ordinary cradle, and when in use they are placed on two blocks of wood, so that the whole may be readily rocked. After the miner has selected his claim, he looks for the most convenient place to set up his "rocker," which must be near a good supply of water. Then he proceeds to clear away all the stones and coarse gravel, gathering the finer gravel and sand in a heap near the "rocker." The shallow box on top is filled with this, and with one hand the miner rocks it, while with the other he ladles in water. The finer matter with the gold falls through the holes on to the blanket, which checks its progress, and holds the fine particles of gold, while the sand and other matter pass over it to the bottom of the box, which is sloped so that what comes through is washed downwards and finally out of the box. Across the bottom of the box are fixed thin slats, behind which some mercury is placed to catch any particles of gold which may escape the blanket. If the gold is nuggety, the large nuggets are found in the upper box, their weight detaining them until all the lighter stuff has passed through, and the smaller ones are held by a deeper slat at the outward end of the bottom of the box. The piece of blanket is, at intervals, taken out and rinsed into a barrel; if the gold is fine, mercury is placed at the bottom of the barrel, as already mentioned.

Sluicing is always employed when possible. It requires a good supply of water with sufficient head or fall. The process is as follows: Planks are procured and formed into a box of suitable width and depth. Slats are fixed across the bottom of the box at suitable intervals, or shallow holes bored in the bottom in such order that no particle could run along the bottom in a straight line and escape without running over a hole. Several of these boxes are then set up with a considerable slope and are fitted into one another at the end like the joints of a stove-pipe. A stream of water is now directed into the upper end of the highest box. The gravel having been collected, as in the case of the rocker, it is shovelled into the upper box and is washed downwards by the strong current of water. The gold is detained by its weight, and is held by the slats or in the holes mentioned; if it is fine, mercury is placed behind the slats or in these holes to catch it. In this way about three times as much dirt can be washed as by the rocker, and consequently three times as much gold secured in a given time. After the boxes are done with they are burned, and the ashes washed for the gold held in the wood.

Unfortunately, on Lewes and Pelly Rivers there is no way of sluicing without the aid of pumps, there being no streams with fall enough to get the necessary current in the sluice boxes.

There is very little reliable information as to the amount of gold that has been taken out of the district since its discovery and development. The following is the best estimate which I can form on the subject:

Stewart River was pretty well worked for two seasons, 1885-86, by about forty men, some of whom made at least $5,000. Assuming that they averaged half that amount, we have $100,000 as their earnings. Forty Mile River, the only other stream from which any large quantity has been taken, was worked in the summer of 1887 by about three hundred men, many of whom spent only a few weeks on the river, some only a few days. The statement made by those of whom I enquired was that all who worked on the river for any length of time made a "grub stake." Putting this at the lowest value I heard placed on it, $450, and assuming that two hundred and fifty men made each this sum, we have $112,500 as the amount taken out on this stream. I have heard the sum placed as high as $130,000.

All the gold taken from the other streams by prospectors would not amount to more than a few thousand dollars, so that it is probable the total amount taken out of the whole district is in the vicinity of a quarter of a million dollars, of which about half was taken out in our territory.

I learned that the prevailing high water interfered very much with the success of the miners in the season of 1888, and that many of them left the country in the

fall. It is probable, however, that a few will remain prospecting until something rich is found.

As Dr. Dawson has reported on the geology of the region along the Lewes, and Mr. McConnell has made an examination of the river from Porcupine River, it is needless to do more than refer to their reports. I may briefly state however that the whole course of the river in Canada is through a mountainous country, the rocks of which, as far as seen, are principally granite, schists, shales and some limestone, the latter at Lake Labarge. There is also some basalt at the cañon and at the confluence with Pelly River.

Just below Coal Creek a range of high mountains comes in from the south-east, and continues down the river, past the boundary. These mountains are composed principally of limestone, with occasional exposure of shale and sandstone.

While going down the river with the survey I located some prominent peaks by triangulation, and determined their height. Unfortunately, I could not, owing to cloudy weather, get as many as I wished. Those located are shown on my map of the survey. I have named a few of them, as they have not, to my knowledge, been previously named.

One of them, seen from the south end of Lake Labarge, on the east side, I have named Mount Dawson, after Dr. Dawson of the Geological Survey. Its altitude above the lake was taken from two points on the east side, from which its distance was, respectively, 724·5 and 773 chains. The height as deduced from the observed angles of elevation of the top from each station was, respectively, 3,238 and 3,263 feet. Part of this difference is no doubt due to want of precision in the instrument used, and part to the fact that the same point may not have been sighted on from both stations. The latter height is probably the nearer to the truth. The altitude of the lake I have put at 1,959 feet, which would make the height of the mountain 5,222 feet above the sea.

Another peak near the boundary I have named Mount Morrison, after a member of my party; and another Mount Gladman after another member. These two peaks are the highest seen from the river in the vicinity of the boundary. Mount Morrison was ascended and its height determined by aneroid barometer, the mean of the readings at starting from and returning to the river being compared with the reading at the top. The difference between the two readings at the river was about fifty feet. The height thus determined was 2,390 feet, which gives the attitude above sea 3,180 feet. Mount Gladman was apparently a little higher.

The only people doing business in the country outside of gold mining were Messrs. Harper, McQuestion & Co. They have been trading at several points on the river pretty constantly since 1873. They occupied Fort Reliance for some years, and in 1886 they established a post at Stewart River to meet the demands of the miners who were working there. They did not anticipate the rush to the country that took place in that year, and their supplies ran short, so that all were for some months on the verge of starvation. Unfortunately, too, scurvy broke out in the camp, and there was much suffering.

In 1887 they established a post at Forty Mile River, whither nearly all the miners had gone, coarse gold having been discovered there during the previous fall. During the winter of 1887–88 they did business at both these posts, Messrs. Harper & McQuestion being in charge at Forty Mile, and Mr. Mayhew at Stewart River. The latter post was kept open principally for the Indian trade, though had there been no miners there it is probable they would have abandoned it. I could not learn definitely the amount of their sales to the miners in 1887, as it is a delicate question to ask a person who is selling foreign goods in Canadian territory to reveal to a Canadian employed by the Government the amount of his trade. Very likely, had I asked the question, I would have received a short answer, though in every other way I am under great obligation to Messrs. Harper & McQuestion for acts of kindness and attention, both sought and unsought.

A person who had a good idea of the amount of their business during the season estimated their sales at $60,000, and from facts which came under my own observation I consider this not far from the truth.

Until the miners visited the country the trade done by this firm was confined to barter with the natives for furs. I understand that they do a sort of commission business for the Alaska Commercial and Fur Trading Company—that is, the company supply goods at a certain advance on San Francisco prices, and deliver them at the trading post at a certain rate per ton. In payment they take whatever pelts have been collected at a certain prearranged price, varying according to the state of the fur market. I understand, however, their freight charges remain constant, and are $30 per ton for goods paid for in furs, and $125 per ton for goods paid for in cash, the latter being the goods imported for the use of the miners.

Their prices for goods in 1887 were not exorbitant, although there must have been a fair profit. They were: flour, $17.50, per hundred pounds; bacon $40 per hundred; beans, $18 per bushel; sugar, $30 per hundred, and tea, $1.25 per pound. Both of these gentlemen came into the country in the summer of 1872, Mr. Harper crossing the mountains from the Cariboo gold fields in British Columbia, and descending Liard River to the Mackenzie. He went down the latter river and up the Peel, whence he crossed to the waters of the Porcupine, which he descended to the Yukon; he then went up the latter to White River, where he wintered.

Mr. McQuestion came in at the same time by way of Peace River, trading for a short time around Lake Athabasca before he descended the Mackenzie.

The principal furs procured in the district are the silver-grey and black fox, the number of which bears a greater ratio to the number of red foxes than in any other part of the country. The red fox is very common, and a species called the blue is abundant near the coast. Marten, or sable, are also numerous, as are lynx; but otter are scarce, and beaver almost unknown.

It is probable that the value of the grey and black fox skins taken out of the country more than equals in value all the other furs. I could get no statistics concerning this trade for obvious reasons.

Game is not now as abundant as before mining began, and it is difficult, in fact impossible, to get any close to the river. The Indians have to ascend the tributary streams ten to twenty miles to get anything worth going after. Here on the uplands vast herds of cariboo still wander, and when the Indians encounter a herd they allow very few to escape, even though they do not require the meat. When they have plenty they are not at all provident, and consequently are often in want when game is scarce. They often kill animals which they know are so poor as to be useless for food, just for the love of slaughter.

An Indian who was with me one day saw two cariboo passing and wanted me to shoot them. I explained to him that we had plenty, and that I would not destroy them uselessly, but this did not accord with his ideas. He felt displeased because I did not kill them myself or lend him my rifle for the purpose, and remarked in as good English as he could command: "I like to kill whenever I see it."

Some years ago moose were very numerous along the river, but now they are very seldom seen, except at some distance back from it. Early in the winter of 1887–88 the Indians remained around the miners' camps, and subsisted by begging until all further charity was refused. Even this for some time did not stir them, and it was not until near Christmas that sheer hunger drove them off to hunt. One party went up the Tat-on-duc some fifteen or twenty miles, and in a short time was revelling in game, especially cariboo. The other party did not succeed for some time in getting anything, although a large district was searched over, but finally went up Coal Creek about twenty miles, and there killed eighteeen moose in one day. They brought in two thousand pounds of the meat to the post, and sold it for ten cents per pound to the miners, with whom it was in great demand on account of the prevalence of scurvy in the camp.

A boom in mining would soon exterminate the game in the district along the river.

There are two species of cariboo in the country; one, the ordinary kind, found in most parts of the North-West, and said to much resemble the reindeer; the other,

called the "wood cariboo," a much larger and more beautiful animal. Except that the antlers are much smaller, it appears to me to resemble the elk or wapiti.

The ordinary cariboo runs in herds, often numbering hundreds. It is easily approached, and, when fired at, jumps around awhile as though undecided what to do; it then runs a short distance, but just as likely towards the hunter as from him, stops again, and so on for a number of times. At last, after many of them have been killed, the remainder start on a continuous run, and probably do not stop until they have covered twenty or thirty miles. When the Indians find a herd they surround it, gradually contracting the circle thus formed, when the animals, being too timid to escape by a sudden rush, are slaughtered wholesale.

There are four species of bears found in the district—the grizzly, brown, black, and a small kind, locally known as the "silver-tip," the latter being grey in color, with a white throat and beard, whence its name. It is said to be fierce, and not to wait to be attacked, but to attack on sight. I had not the pleasure of seeing any, but heard many "yarns" about them, some of which, I think, were "hunters' tales." It appears, however, that miners and Indians, unless travelling in numbers, or specially well armed, give them as wide a berth as they conveniently can.

Wolves are not plentiful. A few of the common grey species only are killed, the black being very scarce.

The arctic rabbit or hare is sometimes found, but they are not numerous. There is a curious fact in connection with the ordinary hare or rabbit which I have observed but of which I have never yet seen any satisfactory explanation. Their numbers vary from a very few to myriads, in periods of seven years. For about three years one may travel for days without seeing more than a sign of them; then for two years they are numerous, and increase for two years more, until finally the country is alive with them, when they begin to disappear, and in a few months there are none to be seen. If it is an epidemic that carries them off, it is strange that their carcasses are never observed in any number.

It appears the martens are also subject to a periodical increase and decrease, and in this case a satisfactory explanation of the cause is also wanting.

The mountain sheep (Big-horn), and mountain goats exist everywhere in the territory; but, as they generally frequent the sides of the highest mountains, they are seldom seen from the river.

Birds are scarce. A few ravens were seen along the river, and three or four remained in the vicinity of the boundary all winter. They were generally more active and noisy on stormy days than at other times, and their hoarse croak had a dismal sound amid the roar of the elements.

A few magpies were seen near Nordenskiold River, and a few white-headed eagles were also noticed.

During the winter, near the boundary, numbers of small birds, somewhat resembling the "chick-adee," were seen, but they were much larger and had not the same note. Of owls, not a specimen was met with anywhere. Partridges were very scarce, only half a dozen or so of the ordinary kind being noticed; but at the head of the Tat-on-duc and Porcupine ptarmigan were abundant. Wild geese and ducks are plentiful in their season, and of ducks there are many more species than I have seen in any other part of the territory. Most of these were observed on the head of the Porcupine; but, having no means of preserving the skins, I had to come away without specimens. A very beautiful species of loon or diver was met with on the Porcupine. It is smaller than the great northern diver, but marked much the same on the body, the difference being principally in the head and neck—the bill is sharper and finer and the head smaller; but its chief distinguishing feature is the neck, which is covered with long, beautiful dun-colored down for more than half its length from the head downwards. I tried to kill one so as to get the skin as a specimen, but after I had fired three times at close range with heavy shot it seemed as lively as if I had not fired at all. I then killed it with my rifle, but the bullet so tore and mangled the skin that it was useless.

With the exception of a small species, locally called the arctic trout, fish are not numerous in the district. Schwatka calls this trout the grayling, but from the descriptions and drawings of that fish which I have seen this is a different fish. It seldom exceeds ten inches in length, and has fins very large for its size, which give it, when in motion, the appearance of having wings. Its dorsal fin is very large, being fully half the length of the body, and very high. The fish is of a brownish grey color on the back and sides, and lighter on the belly. It is found in large numbers in the upper part of the river, especially where the current is swift, and takes any kind of bait greedily. The flesh is somewhat soft and not very palatable. Lake trout are caught in the lakes, but as far as I saw, are not numerous nor of large size. They take a troll bait readily, and a few were caught in that way coming down the lakes, but the largest did not weigh more than six or seven pounds. Salmon came up, I was assured by several Indians, natives of the district, as far as Lake Labarge, and are never found above it, but Dr. Dawson reports their dead bodies along the river for some miles above the cañon. I mention this to show the unreliability of information received from the natives, who frequently neither understand nor are understood.

On the way down salmon were first seen twenty or twenty-five miles above Five Finger Rapids. One can easily trace their passage through the water by the slight ripple they make on the surface and, with care, they can be taken by gently placing a scoop net in their way and lifting them out when they enter it. After coming up the river two thousand miles they are poor, and would not realize much in the market. At the boundary, in the early winter months, the Indians caught some that were frozen in on small streams, and fed them to their dogs. Some of these I saw; they were poor and spent.

I had very little opportunity to learn anything of the language, manners, customs, or religion of the natives on my way through their country, my time with them being so short, and none of the whites whom I met in the district seemed to possess any information upon which I could draw. I got a few items, but as they may or may not be facts, I shall not report them. The statements of every one I met, however, pretty well establish that by one of their laws inheritance is through the mother.

As far as possible I have obtained the numbers of the various bands along the river. Beginning at the coast the number of the Chilkoots, as stated by Commander Newell, was 138 souls, of whom about 40 were full-grown men.

As far as I could gather from G. Carmack, who lives with the Tagish Indians, and has one of them for a wife, there are of them about 112 souls all told, but many of these are almost permanently located with the Chilkoots, some of the latter having Tagish wives.

The Tagish complained bitterly to me, as well as they could, having only a few words of Chinook and English with which to convey their meaning, of the tyranny and robbery of the Chilkoots. Klohk-shun, the Chief of the Tagish, said "Chilkoot all same dog," imitating the snapping action of a dog as he said so. Those who have had any experience with Indian dogs can appreciate the comparison. These people are scattered along the river from the Tes-lin-too up. The only market they have at present for the few furs they collect is on the coast at the head of the Inlet, and they say they are robbed of half their goods on the way there by the Chilkoots. On my way to the summit I met three or four Tagish coming in with two packs of furs, to trade. Meeting me afterwards at the summit, one of them informed me that they were met a short distance outside the village, and one of the packs was taken from them by force, and the other paid for at forced prices. Much of this talk I have no doubt was intended to create sympathy, and induce charity, as they, like many other Indians, are inveterate beggars; but I have no doubt that they are little more than slaves to the Chilkoots, and are both robbed and swindled most barefacedly.

Below Five Finger Rapids I saw two families of Indians, consisting of ten or twelve souls, very poor looking, and the most stupid I have ever met. Wanting to buy some tea and other stuff from me, they tendered in payment the tin stamps that

are put by some manufacturers on plugs of tobacco. These, they signified to us, had been given to them in exchange for furs by the coast Indians. It is possible that they had got them from the Indians on the tobacco, and were trying to swindle me, but I am inclined to think not.

At Stewart River there were two Indian men, two women, and two children. One of the men had picked up a few words of English from the miners and traders the winter before, and, as far as he could be, was very communicative. He informed me that there were about thirty families of Indians up the river twenty or thirty miles, "one day," as he expressed it. They were living on salmon, and had no trouble in catching all they required.

Between Stewart River and Forty Mile River three families were met with, but, as they knew neither English nor Chinook, no information as to their headquarte could be got from them. It is probable they were a part of the band located at Fo Reliance. Mr. Harper informed me that the band at the latter place numbered about twelve families, or, say, 70 souls. At Belle Isle, fifteen miles below the boundary, David's band is located. It numbers 65 to 70 souls. About one hundred miles below the boundary Charley's band has its headquarters. It numbers some twelve families, in all about 66 souls. I came more in contact with the last two bands than with any of the others, as David's band was only twelve miles from my winter quarters for some months, and many of them were frequently in the house with me for a night or two on their way to and from Forty Mile River. A missionary sent over by the Right Rev. Bishop Bompas, who is in charge of the diocese of Mackenzie River for the Church Missionary Society of England, was stationed with David's band all winter.

Some years ago, when Archdeacon McDonald, now in charge of the mission work at Fort McPherson, on Peel River, was stationed at Fort Yukon, and afterwards at Rampart House, Charley's band used to resort to those posts for their trade, and that gentleman taught them to read, and instructed them in the principles of the Christian religion. It is pleasant to be able to testify that they have profited by this instruction, and still retain a loving memory of those times. They hold every Sunday service among themselves, reading from their books the prayers and lessons for t day, and singing in their own language to some old tune a simple hymn. They nev go on a journey of any length without these books, and always read a portion before they go to sleep. I do not pretend that these men are faultless, or that they do not need watching, but I do believe that most of them are sincere in their professions and strive to do what they have been taught is right. They are greedy and selfish in their transactions with whites, but I think much of that is because they have probably never had the sin of undue greed put forcibly before them by their pastor. Their chief, Charley, is a fine specimen of a level-headed, thoughtful Indian, who, up to the time of my departure, at least, did not fail to point out to his people the baneful effect of immoral intercourse with the whites. The majority of the miners, though honorable and generous to a fault in their dealings with the Indians, as far as ordinary dealing goes, have, I am sorry to say, little or no conscientious scruples concerning the moral relations of the sexes, and would not hesitate to take advantage of any weakness in that direction which they might find.

David's and Charley's bands manifested to me a much stronger sympathy for Canada than for the United States. Some of this feeling might be due to policy, for aught I know, but hitherto most of their dealings and all their education have been Canadian. The total number on the river is 482, of whom 136 are below the boundary, leaving 346 domiciled in Canada. It does not appear that any live permanently on the upper Pelly or Stewart.

I shall now give a table of distances from Haines Mission on the coast at the head of Chilkoot Inlet to the boundary. Some distances were given in my interim report published in the Departmental report of 1887, but as they were not corrected for errors in the survey, I now submit a revised table. The error of the survey is found from the difference of latitude, as deduced from the survey, by measuring on the plan the northing made in each day's work, and applying this northing converted into

are to the latitude of the previous day's last station deduced in the same way, and so on from the starting point, Pyramid Island, to the observed latitudes at Fort Selkirk, and at the boundary—the former taken by Dr. Dawson, the latter by myself. The error is cumulative, and distributed pretty uniformily, taking both latitude and longitude into account.

DISTANCES FROM HAINES MISSION.

	Miles.
Haines Mission to entrance of Taiya Inlet	4·79
Head of Taiya Inlet	20·12
Head of canoe navigation, Taiya River	26·02
Forks of Taiya River	28·50
Summit of Taiya Pass	34·88
Landing at Lake Lyndeman	43·18
Foot of Lake Lyndeman	47·61
Head of Lake Bennet	48·21
Boundary line B. C. and N. W. T. (Lat. 60°)	58·21
Foot of Lake Bennet	73·97
Foot of Cariboo Crossing (Lake Nares of Schwatka)	76·56
Foot of Tagish Lake	93·37
Head of Marsh Lake	98·27
Foot of Marsh Lake	117·33
Head of Cañon	143·06
Foot of Cañon	143·68
Head of White Horse Rapids	145·07
Foot of White Horse Rapids	145·45
Tahk-heena River	160·04
Head of Lake Labarge	173·19
Foot of Lake Labarge	204·34
Tes-lin-too River (Newberry of Schwatka)	236·00
Big Salmon River of miners (D'Abbadie of Schwatka)	269·45
Little Salmon River of miners (Daly of Schwatka)	305·66
Five Finger Rapids (Rink Rapids of Schwatka)	364·95
Pelly River	423·41
White River	519·23
Stewart River	529·03
Fort Reliance	602·32
Forty-Mile River	647·20
Boundary Line	687·55

In the appendix will be found my meteorological observations, which I began to keep regularly on the 1st of August, 1887, and carried on till the 1st of November, 1888, but I will here give some extracts from them. First snow of the season on the mountain tops, 10th September. First snow in the valley, 23rd September. Temperature of river water on 1st October, 38·0°. First ice drifting in river, 21st October. Ice set in river, 15th November. Thickness of ice, 1st December, 14½ inches; 3rd January, 40½ inches; 3rd February, 48 inches; 2nd March, 48½ inches.

A small collection of plants was made along the river, and those obtained above the Pelly were taken home by Dr. Dawson. They have been classified by Prof. J. Macoun, F.L.S. A list of them, as well as of those collected by himself, Dr. Dawson gives in an appendix to his report. I take the liberty of extracting from the list, and inserting here those collected by me. Others, not included in this list, from the lower river and the Mackenzie were much damaged by rain. The scarcity of time at my disposal must be accepted as an excuse for my not attending to their preservation.

(1.) *Anemone multifida, D.C.* (cut-leaved Anemone)—Lake Bennet. Common throughout Canada.

(2.) *Caltha palustris, Linn.* (Marsh Marigold)—Chilcoot Inlet. Marshes throughout Canada.

(3.) *Silene acaulis, Linn.* (Moss Campion)—Lake Lyndeman. On mountains and Arctic regions.

(4.) *Oxytropis campestris, D.C.* (Field Oxytropis)—Lewes River, river gravels, and rocky banks northward.

(5.) *Hedysarum boreale, Nutt.* (Northern Hedysarum)—Tagish Lake. Common on the prairies and in Quebec.

(6.) *Dryas Drummondii, Hook.* (Drummond's Dryas)—Lewes River. River gravels in the Rocky Mountains. Lake Superior and Quebec.

(7.) *Potentitta fruticosa, Linn.* (Shrubby Cinquefoil)—Lake Bennet. Common throughout Canada.

(8.) *Saxifraga tricuspidata, Retz.* (Three-toothed Saxifrage)—Lake Bennet. Cold rocky banks, the whole forest region.

(9.) *Ribes rubrum, Linn.* (Wild Red Currant)—Chilcoot Inlet. Common in swamps throughout Ontario.

(10.) *Sedum stenopetalum, Pursh.* (Mountain Stone-crop)—Tagish Lake. Rocky and other mountains; common.

(11.) *Epilobium augustifolium, Linn.* (Fire-weed)—Lake Bennet. Common throughout Canada.

(12.) *Epilobium latifolium, Linn.* (Broad-leaved willow herb)—Lake Bennet. River gravels in the mountains northward and eastward to Labrador.

(13.) *Selinum Dawsoni, C. & R.* (Dawsoni Selinum)—Lake Labarge. New to science. Only found by Dawson and Ogilvie. Described in Coulter's Botanical Gazette, Vol. XIII, p. 144, June, 1888.

(14.) *Archangelica Gmelini, D. C.* (Sea-coast Archangelica)—Chilcoot Inlet. Common on both Pacific and Atlantic coasts.

(15.) *Galium boreale, Linn.* (Northern Bed-straw)—Lake Labarge. Common throughout Canada.

(16.) *Solidago multiradiata, Ait.* (Many-rayed Solidago)—Tagish Lake. High mountains, and north-eastward to Labrador.

(17.) *Solidago Virga-aurea, Linn., Var. Alpina, Bigel.* (Alpine Solidago)—Lewes River. Crevices of rocks, Lake Superior and north-eastward.

(18.) *Aster Sibiricus, Linn.* (Siberian Stav-wert)—Lewes River. River gravels, in mountains.

(19.) *Achillaea Millefolium, Linn.* (Yarrow)—Tagish Lake. Common throughout Canada.

(20.) *Arnica latifolia, Bong.* (Broad-leaved Arnica)—Lake Bennet. Common in mountains.

(21.) *Loiseleuria procumbens, Desv.* (Alpine Azalea)—Chilcoot Pass. Northern mountains and whole Arctic coast.

(22.) *Gentiana Amarella, Var. Acuta, Hook.* (Annual Gentian)—Lewes River. Common in woods and prairies throughout Canada.

(23.) *Mertensia paniculata, Don.* (Paneled Lungwort)—Lake Bennet. Common in cool woods eastward to Lake Superior.

(24.) *Pentstemon confertus. Var. caeruleo-purpureus, Gray.* (Prairie Pentstemon)—Tagish Lake. Common on the prairie and northward.

(25.) *Chenopodium capitatum, Wat.* (Strawberry Blite)—Lake Labarge. Common throughout Canada.

(26.) *Alnus rubra, Bong.* (Red Alder)—Chilicoot Inlet. A fine tree on the Pacific coast.

(27.) *Cypripedium montanum, Dougl.* (Mountain Cypripedium)—Lewes River. South in the mountains through British Columbia.

(28.) *Allium Schoenoprasum, Linn.* (Wild Chives)—Lake Labarge. River and lake shores throughout Canada.

(29.) *Zygadenus elegans, Pursh.* (Beautiful Zygadene)—Cañon of Lewes River. Common on the prairies.

A small zoological collection was also made and sent out by Dr. Dawson. The specimens collected on the lower river after he left, and on the Mackenzie, I brought out myself. They were all handed to Mr. James Fletcher, F.R.S.C., F.L.S. One of the specimens was given me by Mr. James McDougall, Chief Factor in the Hudson's Bay Company's service, who obtained it near the summit of the Taiya Pass. These specimens are classified as follows by Mr. Fletcher :—

(1.) *Papilio Machaon, L., var. Alaska, Scud.*—Three miles below summit of Chilkoot (Taiya) Pass (from Mr. McDougall), 15th July, 1886.

(2.) *Colias Christina. Edw.*—Site of Fort Selkirk, 17th August, 1887.

Those collected on the Mackenzie were:—

(1.) *Papilio Machaon, L., var. Alaska, Scud*—Fort McPherson (Latitude 67° 26′), 21st June, 1888.

(2.) *Pieris Napi, Esper.; Arctic from Byroniae. Oschs., var. Huld.*—Fort McPherson (Latitude 67° 26′), 21st June, 1888.

(3.) *Anthocaris Ausonides, Bd.*—Mackenzie River, 8th July, 1888.

(4.) *Colias Christina Edw.*—Fort Good Hope (Latitude 66° 16′), 11th August, 1888.

(5.) *Vanessa Antiopa. Edw.*—Ninety miles above Fort Good Hope (Latitude 65° 20′), 19th July; Fort Smith (Latitude 60°).

This collection is small, I confess, but it must be remembered that a person cannot very well do two things at once, and at the times when insects generally are most about—clear, pleasant weather—a surveyor is busiest, and generally all the members of his party are busy too. Often have I seen butterflies and moths that I would have liked to catch, but have been occupied at the time with something which I could not leave, and so have lost the opportunity. Many specimens also of plants that I would have been pleased to collect had to be passed, because at the time the canoes were in such a position that we could not stop without much trouble. Very few small animals of any description were seen. Of those which were strange to me, a specimen of what I think is a shrew-mouse was brought out, and handed over to Mr. Fletcher for classification. I have not heard yet what it is.

SECTION 3.

EXPLORATORY SURVEY FROM THE PELLY-YUKON TO MACKENZIE RIVER BY WAY OF TAT-ON-DUC, PORCUPINE, BELL, TROUT AND PEEL RIVERS.

Having got nearly all my supplies down to Belle Isle, on the 3rd of March I left my winter quarters and started therefor with four of the party. Unfortunately, two of my men were unable to accompany me, having fallen ill. From Belle Isle we proceeded to take the supplies already there down the river to the mouth of the Tat-on-duc, using a miner's camp about five miles above it as a halting place on the way. All winter I had availed myself of every opportunity to induce the Indians to meet me at Belle Isle about the 1st of March, and assist me over the head of the Porcupine, or farther if possible, but I could get no definite promise from them, and when the appointed time came I did not even know where they were, but supposed them to be up the Tat-on-duc. Meanwhile, I kept on hauling the stuff ahead as fast as circumstances would permit. On the 13th I had all the stuff down to the miner's camp mentioned, a distance of twenty-two miles by the river, but a winter track, which I followed, by cutting off a large bend, shortened this to about fourteen. This track, however, was so rough and wooded that it is doubtful if it much lessened the labor.

The evening of the 13th an Indian came down to the miner's camp to feel around and see what could be made out of my necessities. As I was anxious to cross to the Mackenzie by this route I made him and his associates an offer of $2.50 a day for each team of dogs with driver, if they would come and transport me at least to the head of Porcupine, or, as they call it, Salmon River. This amount, though it would be considered low in the more southerly part of our territory, was about twice the

amount heretofore paid in that section. He left for home to carry my offer to his companions, promising on his own behalf his support of it. Meanwhile as there was no certainty that anything would come of this offer, I kept on with the party hauling down to the mouth of the Tat-on-duc, and had got nearly half the stuff down there when, on the morning of the 16th, I met nine men and thirty-six dogs on their way to take me, as I understood, to the head of the Porcupine. The rest of that day was spent in cooking for the trip, and fixing things so as to take as little space as possible as the loads would be somewhat bulky. On the morning of the 17th I bade good-bye to the miners with regret, and yet with a thrill of satisfaction that I was now fairly started on the home stretch of my long journey, though over 2,500 miles yet lay between me and the nearest railway, nearly all of which had to be got over by foot or paddle.

Going up the Tat-on-duc I made a compass and track survey as I went along, taking the azimuth of points in the valley, and estimating distances by time and rate of travel. As no member of the Geological Survey staff was likely to pass here for generations, I paid more attention to the geology as I went along than I had heretofore done, and collected specimens of the different rocks I saw. These have been handed over to Dr. Dawson.

As there are no features of special interest on Tat-on-duc and Porcupine Rivers a detailed description of them will not be necessary. When we were at the mouth of the Tat-on-duc the Indians, as I understood them, spoke of some place on the river where warm water comes out of the ground, and keeps the ice over it very thin. I tried to get them to point it out to me, but they either could not or would not understand me, for I saw nothing corresponding to their description anywhere along the river. For three or four miles from the mouth the valley of this stream is about half a mile wide at the bottom, with some fair timber in places. Then it narrows, and up as far as the forks it partakes more of the nature of a cañon than of a valley. While the valley continues wide the ascent in the river is not very steep, yet steep enough to prevent anything larger than a very small boat ever being taken up it. When the valley narrows the ascent becomes much steeper and gives one the impression of going up a hill. The water evidently freezes to the bottom in many places, as it is continually bursting up at the sides and overflowing the surface of the ice, where it is soon frozen. Hence in the spring the ice in places must be of enormous thickness. About eleven miles up, a creek flows in from the north. If I understood the Indians aright, it comes out of the side of the mountain some distance up; they described the water as being warm where it emerges, this being, perhaps, the place to which they had referred as mentioned above. Whether this is true or not, the water where it enters the river is not frozen, nor is it frozen for some distance below this point. This is the point from which the river takes its name of Tat-on-duc, or in English, Broken Stone River, for here it appears the river is always open, and there are many large masses of rock in the channel. Except on the theory of warm water coming into the river, I cannot account for its being open here at the time I saw it, when almost everywhere else it was frozen, even in places where the current is much swifter and rougher than here, where it is quite tranquil.

The river up to this point averages about two hundred feet in width, but just above the open water described it turns suddenly to the south from an easterly direction, and enters a cañon. This is one of the grandest sights I have ever seen; the cañon is forty or fifty feet wide, and the sides rise perpendicularly, on one side to a height of fully seven hundred feet, and on the other probably five hundred, and then slope off to the sides of high mountains. It is nearly a half mile long, and there is a slight bend near the middle, but not enough to prevent one seeing through it from end to end.

After passing through the cañon the river turns sharply to the east again, and continues in this direction till it reaches the forks, about fourteen miles above the mouth. One of the branches comes from the south-east and the other, the one I went up, from the north-east. The Indians often go up the south branch to hunt. As I understood them, it rises in a high plateau distant two or three days' travel, probably forty

miles, and in the same plateau a stream rises which flows to the north, probably into one of the head streams of the Peel. At the forks the precipitous sides of the valley change into easily sloping wooded uplands, with here and there a high peak in the distance. The timber is all small, there being none larger than eight or ten inches in diameter.

The Boundary will cross the river a short distance below the forks. I pointed out to the Indians its approximate position, and made them understand its significance, as I also did on the main river.

The Indians' camp was about nineteen miles up the river, and, as I arrived there on Saturday, they wished to remain until Monday. I agreed, and had the pleasure on Sunday of witnessing their religious service, of which I have already spoken. These Indians build their tents differently from any I have seen elsewhere in the Territories. The tent is made of deer skins dressed with the hair on, which are sewed into the proper shape, elliptical on the ground plan, and dome shaped in vertical section. Willows are fixed in the ground, then bent into the proper curves, and fastened together at the top; the deer skin cover is then placed over this framework, and the tent is banked around with snow. There is quite a large opening left in the top for an escape for the smoke; but, notwithstanding this, a small fire keeps it warm. On the ground it is about eighteen or twenty feet long and ten to fourteen wide. The thick coat of hair on the inside hinders the heat reaching the skin, so that snow lies on the outside of the tent quite a while before it melts. Generally two or more families dwell in one tent.

The winter clothing of these people is made of deer skins dressed with the hair on, and worn with the hair inside. The pants and boots are made in one piece, and the coat is made in the manner of a shirt. In putting it on it is simply pulled over the head, and the arms passed down the sleeves, so that, when it is on, there in no opening for any wind to pass through, and no part of the body, except the face, is exposed to the atmosphere. In the case of children, sometimes the end of the sleeve is sewed up, so that the hand cannot get out, but this is done only when the child is going out. These people had killed a great many cariboo and moose in the vicinity, but they would not tell me how many.

About twenty-five miles up the river we reach a small cañon; the water way is rough, but the sides, though perpendicular, are not high. About four miles above this the Indians report a small lake in a deep valley, which never freezes. They appear to have a superstitious dread of it, saying something about a strong wind always blowing into it, which makes approach dangerous. Around it, they say, many sheep and goats are to be seen, which I suppose can be accounted for by the fact that no one ever hunts there. They pointed out to me the position of the lake as well as they could from the river. It lies in a deep valley at the foot of a very high mountain, which they call Sheep Mountain, the height of which above the river I would estimate to be at least three thousand five hundred to four thousand feet. From the barometer readings along here, the river is not less than one thousand four hundred feet above the sea, so that this peak is upwards of five thousand feet above see level. About three miles above this peak another small but very rough cañon is passed on the river. Three and a half miles above this there is, on the east bank of the river, a low swampy place, from which there is an effusion of sulphuretted hydrogen gas. The odor is quite strong for some distance along the river. An Indian gave me to understand that there was much of the same gas escaping at the lake already referred to. If I understood him aright the danger of the lake is due to violent rushes of the gas, which makes men sick, so that they fall down and roll into the lake.

A short distance further there enters from the east side a creek up which we had to go to avoid an impassable cañon on the main river. According to the Indians this cañon contains a high waterfall, which is impossible to pass, and they describe it as the largest and worst cañon on the river. We have to ascend this creek about four and a half miles, when we turn off it to the left, going up a narrow valley which lies between two high bald mountains, on the bare sides of which we saw many wild

sheep feeding. The mountain on the west side of the pass I have named Mt. Doville; that on the east side, Mt. King. The bed of the creek by which we leave the river is wide and shallow, and the water runs on the top of the ice, thus continually adding to its thickness, till in many places it has the appearance of a small glacier. I am quite sure there are places on this creek where the ice remains all summer. The valley extends eastward several miles, and is surrounded by high mountains. On the south side a curiously formed range skirts the edge of the valley for many miles. It rises sharply from the bottom upwards of two thousand feet to the west, and ends in a table land which seems level southward as far as the eye can reach. On the eastern edge of this table land there stands an immense wall, rising from seven hundred to one thousand feet above it. This wall has the appearance, from where I saw it, of rising perpendicularly on both sides, and its thickness I would judge to be about one-third of its height. It is weathered into queer shapes, resembling in places the views of old ruins one often sees. In one or two places there are large holes in it, which are covered with several hundred feet of rock. One of the holes is so large that through it can be seen the plateau beyond. In the bottom of the valley there are many mounds of gravel which seem to have been placed there by glacial action. There probably was a small glacier in this valley at one time, but it does not appear to have extended any farther down than the river.

At the summit of the pass through the range between this valley and the valley of the main river a magnificent view of the valley is obtained. From this point up the valley is wide, with low sloping sides which end some twelve or fourteen miles up in a large plateau, and beyond this, some twenty miles, the peaks of the Na-hone range break the view to the north. This is one of the grandest views I have ever seen, and the profound stillness and vast solitude impress one as perhaps few other scenes in the world would. The descent from the summit to the river is two and three-quarter miles, in which the fall is about five hundred feet, the barometer at the summit standing at 26·80, and at the river at 27·32 inches. This would place the summit of the pass roughly about three thousand feet above the sea. Around it are peaks which rise at least two thousand feet above it. Some six or eight miles down the river the Indians pointed out the cañon. The valley appears to end there, the mountains are so high and bold.

From the pass upwards the river is shallow, and there are places which look like small lakes, where the water overflows and forms large fields of ice, as in other places described above, but on a larger scale. Eight miles above the pass the river turns sharp to the north, and apparently comes from between two high, sharp peaks, the northerly one of which I have named Mt. Klotz. As far as can be seen, it is a field of ice fully one hundred yards wide, and of great thickness. In some places there are hillocks on the ice formed by the water bursting through and freezing as it overflows. I have no doubt that much of the ice remains through the summer, and may not be wholly melted before the new ice begins to form in the fall, if indeed there is not ice forming during most of the summer months.

Leaving the river, and continuing about a mile up the valley of a small stream coming from the east, we reached the top of a low ridge which forms the watershed between the waters of the Tat-on-duc and those of a stream which the Indians assured me flows into the Peel. I had much difficulty in understanding this, as I could hardly believe that the watershed was so near the Lewes, or Yukon; and it was not until they had drawn many maps of the district in the snow, and after much argument with them, that I gave credit to their statements. I then proposed to go down this stream to the Peel, and to reach the Mackenzie in that way, but at this they were horrified, assuring me as well as they could by word and sign that we would all be killed if we attempted it, as there were terrible cañons on it, which would destroy us and every thing we had; in fact, we would never be heard of again, and they might be blamed for our disappearance. Their statements, in connection with the fact that the barometer stood about 26·65 inches, showing an altitude of over three thousand feet which would have to be descended between there and the Peel, a distance of about one hundred and eighty miles, and probably most

of it in the lower part, caused me to decide not to try it. This river has been named by Mr. J. Johnston, Geographer to the Department of the Interior, "Ogilvie River."

It seems improbable that this river runs as the Indians said, but I afterwards procured other evidence, which proves that it does. I may as well present the evidence here. None of the Indians who were with me at its head were ever down the river. What they knew of it they had learned from the Indians they had met at the Hudson's Bay Company's posts on Porcupine and Peel Rivers, where they formerly used to trade. They told me that they learned more about it at Peel River than anywhere else. Afterwards, in the month of June, when going up Eagle River, I met several families of Indians on the way down to LaPierre's House. One of them could speak a little English, and I got from him all the geographical information I could about the country he had just left. I asked him particularly about this river. He confirmed all that the others had said about it, told me he had seen it several times, and that there were some very bad places on it, places where, as he described it, trees passing down would be all smashed to pieces. He stated that the river we were then on—Eagle River—headed in a small lake, from which they floated down in six days. Hence I would judge the distance to be about two hundred miles by the river; but as the part of it I saw—about twenty-seven miles—was very crooked, and they assured me all the river was just as crooked, the distance in an air line would probably not be more than half the river distance, or one hundred miles. This lake was situated in a large swamp in which a small stream formed which flowed southward to the river in question. From the lake to the river, from their statements, I would judge to be twelve or fourteen miles. Afterwards, in conversation with Mr. McDougall, of the Hudson's Bay Company, I learned that he had often heard the Indians at Fort McPherson speak of a river rising near the Yukon and emptying into the Peel, and so impressed was he by their statements that he thought of utilizing it as a route from the Mackenzie to the Yukon or Lewes. Accordingly, in 1872, he got some Indians who knew the locality to accompany him to its confluence with the Peel, about sixty miles above Fort McPherson, but he found the country so rough, and the river so swift and so unsuited to his purpose, that he abandoned all thought of crossing in that way. The Indians had always assured him that he could not get through, but he wanted personal proof, which he got in abundance in less than two days. All this, I think, shows that the river runs as stated by the Indians. I thought it might be one of the branches of the Porcupine, and at LaPierre's House made enquiries of the Indians, many of whom had been up both branches of that river, but they assured me it was not.

From the plateau at the head waters of the river the valley can be seen running nearly due east for a distance of not less than thirty miles. It is wide and deep. The Indians told me that they sometimes go south-eastward from this point, or, from the head of the valley to the south of this, to the head of the south branch of the Tat-on-Duc, and that, after passing the mountains close to the river, the country is undulating, not rocky, and more or less wooded.

At this point the Indians turned back. Nothing that I could say or offer to them would induce them to go any farther with their dogs, and it was with much difficulty that I persuaded two of them to go ahead with one of my men, and make a track as far as the head of the Porcupine. I paid off the men with the dog teams on the morning of the 22nd of March, when they returned to their families. The other two, with my man, started for the head of the Porcupine, a distance of about fifteen miles. They returned on the 25th, and took their departure for home.

These people have a great dread of a tribe who, they suppose, dwelt at one time in the hills at the head of these streams and still exist somewhere in the vicinity, though exactly where they do not know. While on this plateau they spoke of them in a low tone, as though fearful that they would be heard and be punished for their remarks, which were not at all complimentary. They called this tribe Na-hone; I have generally heard the word pronounced Na-haune by the whites. It appears that they inhabited the head waters of the Liard and Pelly, and were much fiercer than

the neighboring Indians. Probably rumors of their aggressiveness have reached these simple and peaceful people, and created this dread, for they do not appear to have ever seen anything to justify their fears, and when questioned they could not tell anything more definite than that some old man among them had seen some indescribable thing on the mountains when he was a boy, or at some other remote date. They described them as cannibals, and living altogether outside, without shelter from the cold, and believed them to be such terrible creatures that they required no cover, but could lie down anywhere to rest, and did not need a fire to cook their food, but ate it raw. They seemed to ascribe to them supernatural powers, for, when I was trying to induce them to go on farther with me, and showed them my rifle, and told them I would shoot any Na-hone who attempted to molest me, they gave their heads an incredulous shake, as if that was too much to expect them to believe. To whatever it is due, this dread appears to be lively, so much so, that I believe only some pressing necessity, such as hunger, would induce them to remain in this locality for any length of time, and then only if they were in strong force.

From the Tat-on-duc to the Porcupine by the track I followed is sixteen and a half miles. Of this distance thirteen is drained by the river flowing into the Peel. Distributed over this thirteen miles are ten small creeks, which unite eight or ten miles down the valley. I did not go down to the junction, but could from some places see the stream formed by their union, and although so near its head, it appeared to be as large as the Tat-on-duc is about midway of its course. This plateau, except for the ravines in which the creeks run, is tolerably flat. It slopes to the east down the river, and is, as far as can be seen, undulating and wooded. The timber is scattered, and stunted in size; but considering the latitude and altitude it is a wonder there is any at all, the former being 65° 25′, and the latter more than three thousand feet above the sea. Where the woods are open there is much fine short grass. On the creeks the willows attain a large size, as large as generally seen in much lower and more southern countries.

From the watershed between this stream and the Porcupine down to the Porcupine there is a descent of four hundred and fifty feet in a distance of a mile and a half. Where the Porcupine is first crossed on this route it is a large creek flowing northward from between two mountains. The valley can be seen for about six miles up, when it turns to the west and goes out of sight. The stream flows in a bed of fine gravel, and the volume of water was large for the time of the year. About half a mile below this it enters a lake three or four miles long, and upwards of a mile wide. At the lower end of the lake, which lies close under the foot of a lofty range of mountains, the river turns sharp from a northerly to a westerly direction, and in about a mile enters another lake of about the same size as the first one. About two and a half miles below this it enters another lake about two miles long and three-quarters of a mile wide. These three lakes I have called the Upper, Middle and Lower Na-hone Lakes. Below these the river is twice the size that is above. It flows in a valley about a mile wide, well timbered on the bottom, much of the timber being of a fair size. On some of the flats are found many trees over a foot in diameter, long, clean-trunked, and well suited for making lumber.

About five miles below the lower lake a large branch comes in from the west. Perhaps this should be called the river, as it is much larger than the branch I came down, both in width and volume of water. It comes from the south-west, and has quite a large valley which can be seen from the junction of the two streams for a distance of eight or ten miles. The Indians had told me of a large creek down Porcupine River, heading near another creek which flows into the Lewes. They used to go up the latter creek, cross over to the Porcupine, and go down it to fish. From their description and the distance they said it was below the lakes, I first thought this creek to be the one referred to, but afterwards I saw another branch of the Porcupine further down, which is probably the one they spoke of.

Between the upper end of the upper lake and the lower end of the middle one there is a fall of two hundred and fifty feet, and between that point and the lower end of the lower lake a fall of one hundred and forty feet. Thence to the forks the

fall is very rapid, as much as two hundred feet to the mile in some places. About a mile below the forks I found the fall in the river so slight that our canoes could be used with safety. As the labor of hauling my stuff was very severe, I decided to remain here until the ice broke up and go down in the canoes. Accordingly, on the 10th of April, after having got all the stuff and the canoes down to this point, I had a small hut built with a cotton roof, and here we remained until the 21st of May.

I will now refer briefly to the different kinds of rocks seen along the Tat-on-duc and Porcupine to this point. For the first two or three miles on the Tat-on-duc the rock is a very coarse-grained sandstone; in places it might be called conglomerate. At a place four miles up I saw a small exposure of clay shale, colored with oxide of iron where exposed to the air.

Ten miles up the rock at the river level changes to limestone, but high up on the hills the sandstone can still be seen, appearing to be the principal constituent of all the mountains in sight. The limestone continues to the head of the river with occasional exposures of clay shale, in some places of carboniferous appearance. At one point, twenty miles up, occurred an exposure of it so closely resembling coal that at first sight I thought it was a large coal bed. I tried some of it in a fire. It gave off fumes of burning coal for a few minutes, and then became soft and formed a dark grey mass, somewhat resembling scoria, but soft.

Much of the limestone was stratified, but generally it was very massive, with thin veins of what appeared to be calcite, distributed irregularly, but exhibiting usually the cleavage forms of crystals of that substance. Sheep Mountain for about three thousand feet of its height appears to consist of this rock, while the upper part seems to be a sandstone like that seen further down the river. The curiously weathered wall-shaped rock I have described above also greatly resembled this sandstone, although at the distance from which I viewed it it was impossible to tell with certainty.

On the Porcupine River the same limestone predominates. It might almost be said that it is the only rock, there being nothing else but one or two exposures of a bright red-colored close-grained rock, with some small rounded fragments of a bluish-colored stone imbedded in it. There is an exposure of this rock on a creek on the east side of the river a mile and a half below the forks. It underlies the limestone, and is not more than two hundred feet above the river at this place. It apparently continues westward under the drift in the valley, for a ledge of it can be seen under water in the river not far from this exposure. Eleven miles below the forks, about a mile up the valley of a creek on the east side of the river, another large exposure of this rock was seen, but not visited, and no more of it was seen below this.

The mountains about the head of the river rise to an average height of about 2,500 feet, with an occasional peak probably 1,000 feet higher. Between the valley of the Porcupine and that of Ogilvie River the mountains are high and serrated, possessing much more the character of a range of mountains than those on the west side of the Porcupine, where the surface has more the nature of a plateau with peaks rising out of it. The range between Porcupine and Ogilvie Rivers I have named the Nahone Mountains, as the Indians considered them the home of that people, as I have already mentioned.

Looking down the river from my spring camp, on clear days, a lofty peak was visible about twenty or twenty-five miles away. It towered at least one thousand feet above any peak seen near it. I have named this Mount Burgess after the Deputy Minister of the Interior. The top part seemed in the distance to be of different rock from the base. It rose perpendicularly from the *débris* on the slope, and was weathered into castellated shapes. It may be that a portion of the sandstone seen on the Tat-on-duc has been left on this high peak by denudation. I hoped to be able to get a closer view of it on my way down the river, but when I got down to its vicinity it was hidden by intervening peaks.

While waiting in camp on this river for the ice to break up I employed myself in plotting my survey from the Lewes to this point, and, when the weather permitted, in taking observations for magnetic declination, inclination, and total force. I

also took transits of stars over the prime vertical, from which I found the latitddo of the place to be 65° 43′ 00″. I tried on several evenings to observe the meridian transit of the moon for longitude, but could get nothing satisfactory, as at that time of year (May) there was twilight all night, and small stars could not be seen, so that I was restricted to first and second magnitude stars, which, unfortunately, on the nights when I could observe the moon, were few and far between. The mean of three transits is 139° 43′ 00″ west of Greenwich, but this may be in error several minutes.

The mean height of the barometer here during May was 27·60 inches, indicating an elevation of about two thousand feet above the sea level.

Notwithstanding the high altitude and latitude, the timber and shrubbery in the bottom of the valley grew as large and strong as on the upper Lewes, in five degrees lower latitude. Surrounding my camp was a timber-covered flat about two square miles in area, on which grew many nice trees upwards of a foot in diameter. Nearly all of these were spruce, but there were also some clumps of cottonwood, the trees in which averaged nearly as large as is the same species along the Athabasca and Peace Rivers. Willows are abundant along the streams, and grow as large as they generally do in other parts of the territory, being not unusually four or five inches thick. A few white birch were seen. No timber was noticed out of the immediate bottom of the river valley.

Owing to the isolation of this district animal life is abundant. Here, for the first time since we entered the Yukon basin, appeared indications of beaver, several of which we saw when spring came, and one we killed. Otter, too, were numerous, and a few marten were seen, but the latter were not plentiful in this vicinity. No rabbits were noticed, and the only indications of beasts of prey were a few tracks of fox and lynx. Ptarmigan were numerous. These are very pretty birds in the spring when they are exchanging their winter coat of snowy feathers for their summer garb, their color turning on the neck first from a pure white to a reddish brown. Numberless cariboo wander over the mossy slopes. These animals live on a moss which they find high up on the hill sides in the winter, and lower down in summer. I have seen hill sides on which the snow had been pawed over for upwards of a mile in length and a quarter of a mile in breadth, hardly a square rod of it being missed. The animals stand facing upwards, and pull the snow down towards them, uncovering a patch of their food, which cropped, they pull the snow above into its place, and so on to the top. I killed one of these animals, intending to use it for food, but found it so infested with parasitic larvæ underneath the skin (in every way resembling those found on cattle) that the thought of eating it was revolting. In the spring they are also very poor. Their numbers could not be estimated, as they abound throughout the district.

It does not appear that any Indians have hunted here for many years. Apparently their only visits to the district were in going to the Hudson's Bay Company's posts on the lower part of Porcupine River, and on Peel River, before trading posts were established on the Lewes by Harper, McQuestion & Co.: they used at that time to cross by a creek which I identify as one below this point, to be mentioned in its place, build rafts or skin boats, and float down to Bell River, up which they went to LaPierre's House, sometimes crossing to Fort McPherson. As nearly as I could learn from them, it is seventeen or eighteen years since last they made this journey.

Moose are very numerous, and seem to be much less fearful of man than in any other place I have seen or heard of. I had been told that in the winter the Indians pursue them on snowshoes, and run them down. This they actually do, but not until the snow is deep. One day I started after a moose intending to run it until I was close enough to shoot, but this I could not accomplish. It could not get away from me, but I could not gain on it. Had my snowshoes been large enough to support me on top of the loose snow, I could doubtless have captured it; but often, when gaining fast, I sank above the knee in the deep, soft snow, and fell headlong. Before I could get under way again the animal had a fresh start. At last, having run fully

five miles after the brute, I got tired of the unequal contest, and gave up the chase; but not before the moose showed signs of much distress, his tongue hanging out, and being so winded that he stopped whenever I did. I afterwards found that the snow-shoes used for the purpose are made specially large, the rule being that the shoe is made the length of the man who is to use it, and about fifteen inches wide; while my shoes, though of that width, were only about two feet long. Had I used a pair of the proper size I have no doubt as to the result, as often, in deep soft snow, the moose have hard work to get along at all. Of course in shallow snow a man would have no chance in the race. In the winter months these animals live on the buds and young twigs of the willows, and such numbers of them had been near where we were camped that all the willows for miles above and below were cropped almost bare.

On 21st May the river near camp was so clear of ice that I thought it must be open all the way. I therefore started, but when I got three miles down I found the river solidly blocked with ice for miles. Here I was compelled to stay until the 28th.

Before continuing the passage down the river I will mention a few facts bearing on the climate. The lowest temperature in the month of April was on the 4th—37° below zero, and for six days afterwards all the minimum temperatures were below 30° below zero. The last time the thermometer registered a minus reading was the 5th May, minus 1°.8. The highest temperature in April was on the 30th—40 above zero. The highest temperature in May was on the 17th—55°. The first time the snow showed signs of melting was 29th April. The first appearance of insect life was 30th April, when a small fly came out of the river in great numbers, flying about and crawling over the snow. The water in the river began to rise on 6th May. The first geese were heard flying overhead on 8th May; they were flying in a south-westerly direction, as though they had come from the Mackenzie. The common house fly made its appearance the same day. The first swans were heard 11th May. First mosquitoes seen 14th May. First cranes heard 15th May.

On the morning of 28th May we again started in our canoes for the Mackenzie. The river was not yet clear of ice, but sufficiently so to enable us to work along, waiting occasionally for it to move. Ten miles down a very large ice jam was reached, the river being full of ice for about a mile. This had raised the water up into the woods on both sides, so that we could not pack past it, nor could we find camping ground until we went back some distance. Here we were forced to remain the rest of that day. The following morning the jam had moved down so far that, with some difficulty, the dry land could be reached on the east side; so I decided to bring the canoes and equipage to that point and pack everything down to the foot of the jam, about three-quarters of a mile. Just when we had finished this the jam burst, and cleared the river, leaving us no better off than if we had waited. The journey was then resumed.

About six miles below this, or seventeen below the forks, a large creek comes in from the west. This is, I believe, the creek by which the Indians used to come over from the Lewes. Here are many old racks for drying fish, from which I call this creek the "Fishing Branch" of the Porcupine. The waters of this stream are black in color, and clear, while the waters of the main stream are usually blue, though at that time turbid.

While descending the river I determined roughly its fall by reading my barometer every half hour or so, and calculating the descent from the difference of readings. In this way atmospheric changes would affect the result but little, as the change could be but small in such short intervals of time, while the descent was quite rapid. There are no dangerous rapids on this river, but it is all swift, running over a bed of lime gravel. The fall barometrically determined, between the forks and the tributary last mentioned, was three hundred and ninety-five feet, but the greater portion of this was in the upper half of the distance.

Just below the Fishing Branch another extensive jam stopped any further progress for the day. Next day the journey was resumed, but through and over ice for

about eight miles, when another impassable jam was encountered. It was piled up until the water filled the whole valley, but by wading, packing and canoeing through the woods it was safely passed. Here I made an ascent of one of the hills bordering the river, and found it to consist of the limestone already mentioned as constituting the bulk of the mountains further up. The timber was much the same, with the addition of some small tamarac. The journey was resumed in the evening. At one point there is a sudden turn in the river, and just below it a rapid which is very rough, but has no rocks in it. This was entered before there was any time to stop, and it had to be run, with no other mishap, fortunately, than one of the canoes filling with water and nearly sinking before we got through.

Twenty miles below the Fishing Branch the river leaves the mountains, the last peak near it being on the west side, and so close that the river runs under its base. This I have called "Mount Dewdney" after the Hon. the Minister of the Interior. It is of the same limestone formation as all the others. No sign of stratification was observed along the Porcupine, nor were traces of organic remains anywhere seen. Mt. Dewdney rises about two thousand five hundred feet above the river, or nearly four thousand feet above the sea, the river here being about one thousand three hundred feet above sea level. The fall from Fishing Creek to the base of this mountain is three hundred feet. As far as can be seen from this point the mountains trend east and west. Those on the east side of the river were apparently not so high, and they gradually sloped off as if another deep valley pierced them at no very great distance to the east.

From here down the river winds through an undulating and wooded country, the banks being nowhere more than eighty to a hundred feet high, and generally consisting of clay, with occasional exposures of black shale, which decomposes into a rich black clay. The timber on the uplands, though thick, is not large enough for any other purpose than fuel. This description answers generally for the whole valley down to the mouth of Bell River. In the bottom, close to the river, there are scattered clumps of spruce that would make fair lumber, but not sufficient to induce any one to think of it as an article of trade. About thirteen miles below the mountains a large rock exposure occurs on the east side of the river. It extends for about half a mile, rising three or four hundred feet above the level of the river, and is weathered into fantastic resemblances of old buildings. I have called it Cathedral Rock, from its resemblance to some old churches I have seen pictured. The rock appeared to be limestone, but I am not sure. It may have been sandstone, but as it was some distance from the river I did not take the trouble to go to it.

About twenty-five miles below the mountains, and three or four miles to the west of the river, a high wooded, terraced ridge rises out of the plateau; another one, much the same in appearance, can be seen further west. They appear to be the result of denudation. A smaller one is seen below this about three miles.

About thirty-eight or forty miles below the mountains a large tributary comes in from the south-west, but I noticed no valley in the mountain range out of which it appeared to come. It is probable that it skirts the northern edge of the hills for some distance west, and is fed by small streams issuing from them. Above this tributary the current, though not rough, is generally so swift as to prevent steamboat navigation. Below the junction no difficulty would be found in running steamers of moderate power. What draught the summer stage of water would allow I had no means of determining, but I think a flat-bottomed boat drawing two to two and a-half feet could always find water enough. I used to try with my paddle where I had reason to think it shallow, but never found bottom, and, as the banks are flat and low, it seems likely that there is not much variation in the height of the water in this part of the river.

About a mile and a-half below this stream the river is joined by another from the south-east, apparently as large as the one I came down. The average width below the mountains of the river I had followed was from one hundred to one hundred and fifty yards. The width of the other branch is about the same. I afterwards learned that the Indians in the vicinity of LaPierre's House go up this branch to the moun-

tains to hunt. The band that most frequents it was up at its head when I passed, so that I could learn nothing definite about it. The fall from the mountains down to the mouth of this branch is four hundred and sixty feet, one thousand and fifty-five feet in all from the forks above my spring camp, the distance being about seventy-eight miles, and from the Lower Na-hone Lake the fall is about one thousand three hundred and fifty feet in a distance of about eighty-two miles. From this we get the altitude of the confluence of these two large branches as approximately nine hundred and fifty-five feet.

From this point down the fall is not noticeable by barometer, and the current is very slow—so slow that a head wind of twenty miles an hour would almost drive the bare canoe up stream. Below this to Bell River the river runs through an undulating country, covered with small spruce, white birch, and some cottonwood. The soil is all clay, and if the climate would permit, it would rank well as an agricultural country. There are some exposures of much weathered clay shale along the river. Below the junction of the two branches the river averages from two to three hundred yards in width, with banks twenty to forty feet high. From the junction to Bell River the distance by the survey is about sixty-seven miles; but it must be borne in mind that this measurement does not follow the windings of the river, which would about double it. Sights were taken from point to point in the valley, and the distances estimated. The river is in general very crooked, and there are some large islands in it. The barometer readings were noted at frequent intervals to get the fall in the river; but as the fall was very gradual, not much reliance can be placed on the result obtained in that way. However, I give it for what it is worth. In the last stretch it was one hundred and thirty feet, thus making the altitude of the mouth of Bell River eight hundred and twenty-five feet above the sea. I have a check on this result, which will be given further on.

Bell River enters the Porcupine from the east. At its mouth and as far up as its confluence with Eagle River it is about one hundred yards wide, with low banks thinly wooded. To the north at some distance are high hills, wooded well up the slopes. The Rocky Mountains can now plainly be seen to the east twenty to twenty-five miles away. I got a poor observation for latitude at the mouth, and found it to be 67° 19′.

For about ten and a-half miles the general direction of the river is north-east, it then takes a general south-east direction for nine and a-half miles to where Eagle River enters from the south. By mistake I went up this river one day's journey, about twenty-seven miles. Here I met some Indians who had been hunting at its head waters, and were now on their way down to LaPierre's House. The country along it, as far as I went, is flat, and near the river timbered with spruce and cottonwood of the same general character as that on the Porcupine. The soil is generally clay, but occasional sand banks overlie the clay to a depth of fifty to one hundred feet. These banks are few and isolated from each other, and appear as if deposited by a sea, the intervening tracts being afterwards washed away. About six miles from Bell River an exposure of coarse-grained sandstone, much resembling that on the Tat-on-due, was seen, but it is stratified. The strata, however, are thin, not more than a foot in thickness, and much bent. This exposure could be seen along a bend of the river for two hundred yards only, and rose but ten to fifteen feet above the water. As far as I followed it, this river is very crooked, with a moderate current. Just above the sandstone exposure there was a slight ripple, while another just below it showed shallow water—only three feet. I understood from the Indians that this spot is very shoal in low water, there often being not enough water to float a canoe over it. They describe the whole river as much the same in character as the part I saw, and the country along it as generally flat, and all timbered. They say game is plentiful along it. They had gone up in March and hunted until June, when, some of them having made rafts and others skin boats, they came down to dispose of the furs they had captured. To make a skin boat they sew together the necessary number of deer or moose skins raw with the hair taken off. A keel is laid down, and willow ribs and frame work of the proper dimensions attached to it.

The skin cover is then softened in water, and stretched over it; then, when dry, the skin is well rubbed with melted fat. When the trip for which it was built is over the skins are taken off and used for other purposes.

When I learned from these Indians that I was on the wrong river I at once turned back and reached Bell River at one o'clock a.m., having started at nine. The sun could occasionally be seen down the valley of the river to the north, well above the horizon. The people in this district, in the summer months, do nearly all their travelling and labor during what, in our latitudes, would be the night, of which, at this season of the year, they have none. Their reason is that it is cooler to labor then, and warmer in the day hours to sleep.

I induced one of the Indians who could speak a little English to acompany me to LaPierre's House. After resting a few hours at Bell River after our long day's labor, we started. On the way we had to break through three ice jams. It surprised the Indians much to see us dash our canoes on a sheet of ice, and often break it in that way. If the ice proved strong enough to carry us we got on it, hauled the canoes across, and embarked again, to repeat the operation on another mass. The ice by this time was generally pretty rotten, but often masses of sound ice upwards of five feet thick were encountered. When one gets into a jam of this kind he has to keep a sharp lookout, lest his canoe be crushed, and often, to save it, he has to jump upon the ice, and haul out his canoe as quickly as he can. We labored hard in this way all day, and reached the House about nine in the night, or rather afternoon, of 6th June. There were many natives here, and our canoes and outfit generally were a great novelty to them. Our Indian's account of how we worked with them through the ice astonished them greatly, and they thought the white man's canoe almost a creature of life and spirit.

June 7, I spent at the House. I intended to determine the latitude; but just before noon the sky clouded, and all I could get was a very poor meridian altitude of the sun, through clouds. This gave me 67° 23′ 41″. I observed for magnetic dip and total force, but not for declination, as I had no means of determining the meridian reading of the instrument.

A mile above Eagle River, Rock River flows into Bell River from the south-east. It is about fifty yards wide, shallow, and in its bed are many large rocks—hence its name. The Indian with me told me it rose far up in the Rocky Mountains, and that it took many days to reach the head of it. He pointed out from its mouth its general direction, which is about south-east.

About three miles above Rock River there is a slight rapid, which, however, would not prevent navigation. At this point on the east side of the river is a high rock cliff, consisting, as I suppose, of clay shale; but as Mr. R. G. McConnell, of the Geological Survey staff, passed through here on his way down the Porcupine, he no doubt has examined it, and reported upon it, as well as upon all other rocks in the vicinity.

A short distance below the House, Waters River enters from the north-west. It is a stream about forty yards wide, and appears to have a considerable volume of water. It is said to be forty to sixty miles long, rising in a range of mountains which can be seen from its mouth.

About five miles above the House in an air line, but much more than that by the river, which is very crooked, Rat River joins from the east. It is a small river fact is hardly worthy of the name. On it LaPierre's House was first built, but getting scarce it was moved to its present site. Only a short time before it will have to be moved again, as wood is getting scarce n[illegible] position and has to be hauled some distance. The post here is kept u[illegible] mainly f the meat it furnishes, the country around it abounding with game. The tongue of the deer or the moose is considered a delicacy, and the Indian generally brings to the post, as he gets more for it than he would for an equal weight of other meat. The clerk in charge informed me that he had sent away that year thirteen hundred tongues to other posts, so that probably about two thousand animals were killed in this vicinity.

Bell River is named after Mr. J. Bell, of the Hudson's Bay Company, who crossed to it and descended it to the Porcupine in 1842. He also followed the Porcupine below the junction for three days. Porcupine River, I understand, was called so on account of the numbers of that animal that existed in its valley. Why Eagle and Rat Rivers were so called I did not learn.

The route always travelled from this post to Fort McPherson crosses the mountains in a pretty direct line. There are two routes: one for winter travel and one for summer. The distance between the two points is called about eighty miles, and it generally takes three days to make the trip.

All the trading outfit for LaPierre's and Rampart Houses has to be brought this way in the winter months on dog sleighs, and the furs and meat received for it have to be taken to Fort McPherson in the same way. From there the furs are sent out by the Mackenzie. This is so costly and slow that in 1872 Mr. James McDougall, (now Chief Factor), then a clerk in the Hudson's Bay Company's service, thought of trying some more convenient and expeditious way. Accordingly he made an exploration and survey of a pass through the mountains to the north of this route, with a view to building a waggon road through it, and using oxen to transport the goods from one waterway to the other. I went through this pass on my way to Fort McPherson and will describe it in its proper place.

Mr. McDougall, also, in July, 1873, when the water was unusually low, made soundings in Bell and Porcupine Rivers to determine the practicability of steamboat navigation, carefully examining both rivers in places suspected of being shallow. Between LaPierre's House and Yukon River he found five shoal places where the depth was less than four feet. The depths and localities of these he has kindly furnished me. The first is at Sinclair's Rock—in the rapids I have mentioned as being below LaPierre's House. Here the shallowest place was three feet six inches deep. Next, a short distance below Bell River in the Porcupine, he found only two feet eight inches. This place he considers could be easily improved. Approaching it, for one hundred yards the water is three feet deep; then occurs rock (sandstone he thinks), with a depth of water two feet eight inches for ten yards, when it suddenly drops to four feet. The other three places are between Rampart House and the Yukon, and, consequently, in Alaska. Their depths in the order of descent were, respectively, three feet ten inches, three feet six inches, and three feet four inches. At one of these places there was an island close to one shore and Mr. McDougall naturally took the wider channel to be the deeper, but he afterwards learned that the narrow channel was quite deep.

On the morning of 8th June I started from LaPierre's House to go up Bell River to the pass above-mentioned as having been explored and surveyed by Mr. McDougall, having as a guide the Indian I had brought from Eagle River, who had been through the pass once or twice and was supposed to know all about it. I carried on the survey, as on the lower part of the river, by taking compass bearings of prominent points on the river and estimating the distances to them. In this way I made the distance to the point at which we leave Bell River to go through the pass to be about twenty-one miles; yet, owing to the many and long sinuosities of the river and detentions from ice jams, one of which delayed us half a day, it was three days before we arrived there. The current is nowhere strong, but there are some shoal places where the heavy ice, fully five feet thick, grounds and piles up until the accumulated water behind pushes it over.

On the morning of the 12th my guide told me that most likely we would reach the mouth of the creek, which flows from the pass, about dinner time. Judge my surprise, therefore, when a few minutes after starting he pointed to the mouth of a stream almost hidden by willows and alders, and asked if I thought that was the creek in question, and when I said "No," he assured me it was. I could not believe him until I went ashore and found the preparations that had been made by Mr. McDougall to build a storehouse in which to deposit the goods brought through the pass. I may here call attention to the length of time hewn timber in this country will preserve a fresh appearance. Here were trees cut, and sticks hewn in 1872, yet

had I been asked what length of time they had been cut I would have answered "A year or so." I noticed the same thing on the Upper Porcupine—cuttings there seeming to me to be only a few months old; yet I knew from what the Indians told me that they were quite as many years as I thought months.

The canoes were put into the creek, which is only thirty to forty feet wide. For the first two or three hundred yards the water was deep, and smooth enough to paddle along with ease, but then came the end of our pleasure. The creek for about a mile and a-half was one continuous rapid, not dangerous, because there was not enough water to hurt anyone, but so shallow that it would hardly float the canoes when all the men were out of them; so we had to wade in the ice water, while snow was falling, and drag our canoes, with our outfit in them, over the bars and stones in the creek, until at last even that comfort was denied us, for we reached a part of the stream where the ice was still solid, and at least ten feet thick, so that everything had to be packed for nearly a mile, to where the creek was again clear of ice, when we re-embarked and floated up about three miles in a straight line, but certainly twice that distance by the stream. Here everything had to be carried about four miles across the watershed of the pass to a creek which flows into Trout River, a tributary of Peel River. On the summit of the pass are several lakes, which, had they been open, would have reduced our packing to less than half a mile; but the ice was still solid, with only a few pools of open water around the edges.

On the morning of the 15th everything was got across to waters flowing to the Arctic Ocean, but the creek was so full of snow and ice that it did not help us much; and, although it was only three and a-half miles to Trout River, the whole day was consumed in getting there. This pass, which I propose to name McDougall's Pass, after the man who first explored and surveyed it, is wide and level, the valley being nearly a mile wide at the bottom, and very flat. It is almost treeless, only a few stunted spruce being found near the lakes, and a few willows on the creeks. Some coarse grass grows in the valley, but when I was there, there was no sign of growth. The distance from Bell River to Trout River I estimate to be fourteen and a-half miles. On the north side of the pass I have named two prominent peaks "Mt. Dennis" and "Mt. Russell."

I may say here that I compared notes of survey with Mr. McDougall, who measured his distance with an error probably not greater than one in a thousand. His survey followed the valley of the pass from bend to bend and cut off many turns in the river, while mine followed the course of the river more closely, and is consequently somewhat longer, the actual difference on the whole distance being about five miles; but when I take off my plot a length corresponding as nearly as possible with a line of Mr. McDougall's survey, I find the difference very slight. Many of his pickets were still standing, with a piece of sod on top of them, as fresh-looking as though they had been planted but one year instead of sixteen.

Returning now to the question of altitude, I will calculate the height of the summit of the pass from that of the mouth of Bell River, and compare it, found in that way, with the altitude deduced from the descent of Peel River.

I have put the altitude of the mouth of Bell River at eight hundred and twenty-five feet; allowing a rise of a foot to the mile in that river we get eight hundred and fifty feet for the altitude of LaPierre's House. Continuing the same rate to the west end of the pass we got about nine hundred and twenty, the distance by the river being about seventy miles. By barometer readings the difference of elevation between Bell River and the summit of the pass is about two hundred and fifty feet, but this determination is unreliable on account of the length of the time elapsed between the readings at the two places. From the appearance of the slope I would estimate the rise to be not more than two hundred feet, if indeed as much; but assuming the barometric height as correct, we have eleven hundred and seventy feet as the altitude of the summit. While going from the summit down to Peel River I determined the rate of fall by half-hourly readings of the barometer, as I did on the Porcupine. This gave the fall from the summit to slack water on Trout River as eleven hundred and thirty feet. The last point is seventy or eighty miles from the Arctic

Ocean, and probably as many feet above it, thus making the height of the pass about twelve hundred feet, or only thirty feet more than the determination by way of the Porcupine. It cannot be claimed that either determination is correct, or that this close agreement is anything more than chance; yet it is much more satisfactory to have them so than with a large difference.

From where we enter Trout River by this route to the head of slack water is about twenty-four miles by the river. In this distance the fall is one thousand and ninety feet; but to determine what the grade of a road built on this, by far the steeper side of the pass, would be, we have to assume a nearly straight line, instead of following the bottom of the river valley. This would reduce the distance to about twenty miles, thus giving an average grade of fifty-five feet to the mile on this side of the pass. This is not too great for any kind of roadway which may be built here.

The Indian with me said that both Bell River and Trout River rise far up in the mountains; that he had been several days' journey up both, and that there they were still quite large. He also said that Bell River, a short distance above the pass, is rough, with a generally swift current, and many small rapids. Trout River, where we strike it on this route, is about fifty yards wide, shallow and very swift. The mountains on both sides rise two or three thousand feet above the pass, with many isolated, high, sharp peaks. Most of the rock I saw was granitic; some quartzite is found on the south side of the pass at the summit. Mr. McDougall, who appears to have travelled all through the mountains in this vicinity, told me of an immense dyke which he saw in the hills on the south side of the pass. He described it as bridging a deep and wide ravine, presenting the appearance of an immense wall across it. Three or four miles down Trout River from the pass a small specimen of asbestos was picked up in the drift in the river. In a conversation with Mr. McDougall I mentioned this, and asked him if he ever came across any of it in his ramblings through that district. He informed me that not far from the place where I found the specimen there were several veins of it at the foot of the slope on the south side of the river. The rocks seen along the river here are not the rocks usually associated with asbestos, but Mr. McDougall's evidence is that of an eye-witness.

Ten and a-half miles down the river we reach the cañon. Here we are out of the mountains, and the character of the rock along the river changes completely, being here sedimentary. The walls of the cañon are a stratified sandstone, the top strata appearing to be harder than those lower down. There are exposures of this rock all the way down to the foot of the swift water. I never could stop when near an exposure to examine it, as there was always a rapid alongside it, but it resembled in appearance the friable sandstone seen throughout the North-West.

At one place, while I was running past a cliff in a rapid, I saw what seemed to be a coal seam in the face of the cliff. It was three feet or more thick, and extended the whole length of the cliff—about a quarter of a mile. I told Mr. McDougall of this, and he informed me that he had found the same seam, and had taken some of the coal to Fort Simpson, to be tried in the blacksmith's forge there, and it was pronounced a fair quality of coal. The last rock exposure seen in descending the river is just at the foot of the swift water. On the north bank there is a low cliff of soft red sandstone, much weathered, as well as worn by the water of the river, which shows its softness.

The walls of the cañon, in which the river takes a sharp turn, are about eighty feet high. On the outside of the curve the walls are perpendicular, but on the inside they are not so steep nor so high. It appears as if there had been at one time a fall over this sandstone barrier, since it extends completely across the river valley, and is not more than a hundred and fifty yards thick. Above the cañon the river is generally wide and shallow. In many places it is spread over gravelly flats, so that in very low water one could easily conceive the river flowing through without any water being visible. The fall in the ten and a-half miles is three hundred and sixty feet. The current is always swift and rough, but there is no danger in navigating it in canoes, excepting a liability to rub the bottom once in a while. The fall is uniform to the cañon, but below it there is a succession of rapids with short intervening

stretches of easy water. The fall between the cañon and the head of easy water is seven hundred and thirty feet, which, in a distance of fourteen miles, gives fifty-two feet descent to the mile. This would not be at all dangerous over a uniform slope and a smooth bottom, but divide it into two or three rapids, and throw a lot of large rocks into them, and it makes running through them in a small boat exciting to say the least. Fortunately for us, we got everything through safely, the only inconvenience being that the canoes had to be bailed out at every rapid. It is often said that "it is the unexpected that always happens." This, my experience on this trip verifies in a small way. My canoe had come through all the various vicissitudes and dangers of a thousand miles, and had safely run over this the last rough water it would have to encounter, but in the last yard it struck on the end of an unseen stick, which fractured the side so that the canoe would have filled in a short time. It was unloaded, the fracture filled with white lead, the side pressed back to its original shape and fixed there by a piece fitted to the inside, and rivetted with wrought nails, and the canoe was again to all intents as good as before.

Mountain goats and big-horn sheep abound in the hills around the pass. While going through I saw how the Indians, by stratagem, sometimes secure cariboo and moose, when the snow is not deep and they are consequently hard to approach. A ravine which is full of snow is selected, and round it, on the lower side, is built a brush fence, which is extended outwards and backwards to the uplands on each side, diverging until the ends are some miles apart. The fence consists merely of crotched sticks stuck into the snow at suitable distances, with poles laid horizontally in the crotches, due care being taken to cut and mark it so that the agency of man in its erection is made very evident. A party then scours the country around the mouth of the trap, all the time gradually approaching it, driving any animals in the vicinity, by noises and other means, between the arms, which the brutes avoid as soon as they see. They are thus gradually driven to the snow pit at the end where they are easily despatched. Had the brutes sense enough they could easily dash through the fence, but they will not approach it.

From the foot of the rapids to Peel River the current is very slow, and about four miles down the river branches, the southern branch spreading out into numerous lakes, in which we were a day paddling around trying to find our way out. In most of them the ice was still floating. Had the Indian taken the north channel we would have saved nearly a whole day in time, but he thought the south channel was the right one until we were lost in it, and then recollected that we should have taken the other one. These channels join again below the lakes and continue on to Peel River.

The surface here is flat and swampy, with much good timber. Although this was the most northerly point reached (about 67° 45′) the trees on this flat were as large on the average as those seen anywhere else on the survey. The Indian told me they called this part of the river Poplar River, from the fact that much of that wood grows along its banks near the mouth. That poplar grows on it is no very distinguishing feature, so I propose to name it Trout River, from the abundance of trout that are caught in it up in the mountains. According to the Indian's story they are very abundant.

Two streams join Trout River, one a mile below the cañon and the other just at the foot of the rapids. The first is about as large as Trout River above the confluence. The Indian gave me its name in his language, but it was almost unpronounceable. When translated it was in English "The river that is filled with snow." This name is given because up in the mountains the valley is drifted full of snow in winter, some often remaining until the next winter. He said if we went up the valley we would see the water running under snow arches for long distances. I had seen a similar phenomenon on a small scale for two miles on a creek in McDougall Pass. The river comes from the south, and the trail from LaPierre's House to Fort McPherson crosses it. The other river, called Long Stick River, comes from the north-west, and is not more than eighty feet wide at its mouth.

Peel River was reached on the evening of the 19th June, and on the morning of the 20th, at eleven o'clock, we arrived at Fort McPherson.

Section 4.

Exploratory Survey from Fort McPherson to Fort Chipewyan by way of Peel and Mackenzie Rivers, Great Slave Lake and River, and Lake Athabasca.

Fort McPherson is built on the east bank of Peel River, some fourteen miles above the point where it divides and joins the Mackenzie delta, which is common to both rivers.

The fort stands on a high bank, consisting of gravel, under which some shale can be seen close to the water. About a mile down the height of the bank decreases from fifty feet or thereabouts to ten or twelve, and consists wholly of alluvial deposits. The river at the fort is about half a mile wide, with moderate current.

The country surrounding the delta of the Mackenzie has evidently been a part of the Arctic Ocean which has been filled up with deposits brougnt down by the river.

On this soil the growth of timber is, for the latitude, very large and thick, many spruce of from twelve to fifteen inches diameter occurring along Peel River, as well as along the Mackenzie for some miles up.

At Fort McPherson I at once set about making preparations to resume the micrometer survey and carry it from this point to Fort Chipewyan, on Lake Athabasca, there to connect with my micrometer survey of Athabasca and Peace Rivers. The 21st and part of the 22nd of June were spent in this way.

On the 21st I tried to make some observations for latitude; but as the sun never set I could get only one or two meridian altitudes of first magnitude stars in addition to that of the sun. The instrument used was faulty, so that the result, 67° 26′, cannot be accepted with much confidence, as it may be in error a minute or more.

I observed on the sun, east and west, for azimuth, and that night did what no other Dominion Land Surveyor has, I think, ever done, viz., took the sun's lower or midnight transit across the meridian for time.

On the 22nd I took a set of magnetic observations, and all the necessary preparations for the survey being completed, started the work at six o'clock that evening, completing about seven miles.

I could find no one around McPherson who knew much about Peel River, and as my own observations were confined to that part of it below the fort, I am not able to say much about it. The distance from the fort to where the river branches into the Mackenzie delta is thirteen miles, and through the delta to Mackenzie River proper, thirty-one and a half miles.

Between Peel River and the Mackenzie about two-thirds of the channel in the delta averages more than a quarter of a mile wide; the remainder about one hundred yards. All of it was deep when I passed through, and the Hudson's Bay Company's steamer "Wrigley," drawing five feet of water, finds no difficulty in navigating it.

The banks do not rise more than ten or fifteen feet above the water, and the current is continually wearing away the soft deposit and carrying it down to the lower part of the delta and the Artic Ocean.

Where we enter the Mackenzie proper the channel is three-fourths of a mile wide, but it is only one of four, there being three large islands there. The whole width of the river cannot be less than three or four miles.

Looking northward down the westerly channel the view is bounded by the sky, and widens in the distance so that one can fancy he is looking out to sea. This can hardly be so; but from the altitude of the bank where I stood, added to my own height, the horizon must have been six miles away; and a bank in the channel of equal height to that on which I stood would have been visible twice that distance. Now, if the supposed bank was timbered, as was that on which I stood, it would be visible ten or twelve miles farther, but none was in sight.

From the entrance of the small channel of Peel River to the head of the upper island in the Mackenzie is nine miles. From the west shore to the southerly point of this island is a mile and a quarter; from the island to the east shore the distance is nearly as great, showing the river to be more than two miles wide at this point.

However, it gradually narrows, and five miles above this is little over a mile wide, which it averages up to the narrows, about sixty miles from Fort McPherson, or twenty-eight from where we entered it.

A north wind raises quite a swell here, and the salty odor of the sea air is quite perceptible above the delta.

The banks continue low and the country flat on both sides of the river for some nine miles above the islands.

The shore on the east side is sloping, while that on the west is generally perpendicular, showing the action of the current, which is wearing into and carrying away portions of it. This form of bank changes into steep shale rock, that on the east being about fifty feet high and that on the west apparently sixty to eighty. Both banks are perpendicular, and gradually increase in height as far as the Narrows, where they are probably one hundred and fifty feet above the water. The easterly bank through the Narrows is almost a sheer precipice to the water, but that on the westerly side is not quite so abrupt.

Red River enters the Mackenzie on its west side just at the foot of the Narrows. It is about two hundred yards wide at its mouth and appears to be shallow. As far as I could learn from persons acquainted with the river, it comes from a flat, swampy country.

A winter trail crosses from Fort McPherson to the Mackenzie near the confluence of Red River, and the surface of the country along it is said to be covered with woods, marshes and ponds.

In the Narrows the Mackenzie is nearly three fourths of a mile wide for a distance of five or six miles, when it expands to its normal width of a mile or more. In one part of the Narrows there was not more than five feet of water on the west side of the river for some distance out from shore. In low water this becomes bare, and reduces the width of the river to half a mile for a short distance. Hence, this place is called the Narrows. The current here is swift, being not less than four and a-half miles per hour. Coming up the river, we turn sharply at this point from south-east to north-east, but after passing the Narrows we resume the former course.

A few miles above the Narrows the banks change from rock to clay and gravel, and continue generally steep and high as far as Fort Good Hope. In a few places the bank recedes from the river for a short distance, forming a low flat, on which generally grows some fair spruce timber. I noticed that these flats are being eaten away by the action of the current and waves. The greatest extent of level ground I saw is at the site of Fort Good Hope, on the west side of the river; but, as I came up the east side, I cannot say exactly what the timber there is like, but judging from its appearance at the distance of a mile it is large and long.

From the delta up the river is clear of bars and islands during the stage of water at which I saw it, for a distance of about eighty miles. It then widens to two miles or more, and there are some scattered bars and small islands. The current is uniform, as one would expect in such an immense volume of water, and never exceeds four miles an hour. There are many places where, looking up and down the valley, the view is bounded by a water horizon, and it has more the appearance of a lake than a river.

Wherever possible the width of the river was determined by triangulation. Between the Narrows and Fort Good Hope it is never less than a mile wide and is often more than two, even reaching three miles at some points.

Since I followed the shore, I cannot speak of the depth of water from personal observation. Capt. Bell, of the Hudson's Bay Company's steamer "Wrigley," informed me that the shallowest water found by him in any part of the river, in what he considered the channel, was eleven feet. But as, when I saw him, he had made only two trips on the lower river, he could not speak very definitely as to its depth. Sir Alexander Mackenzie, who discovered the river and descended to its mouth in July, 1789, had a lead line with which to make soundings; but in the swift current a short distance above Fort Simpson his lead caught in the bottom, the line broke, and the lead was lost. I have the depths according to him, and will give them in their pro-

per place. One would expect, in such an expanse of water as this, to find some of it shallow, but it appears from all the evidence I could gather that vessels drawing from eight to ten feet of water would find no difficulty in navigation as far as Great Slave Lake. Although the river is reported to be shallow where it leaves this lake, doubtless a channel could be found affording the draught above mentioned.

No rivers of importance flow into the Mackenzie between Red and Hare Indian Rivers. Sixty miles above Red River a stream one hundred yards wide enters from the north-east. I think this is a river which an old man at Fort Good Hope described to me as one up which a Hudson's Bay Company's officer went many years ago to its source, which he found to be not far from the head waters of Anderson River, which flows into the Arctic Ocean. It would appear from the old man's statement that several trips up it have been made since; but his information was vague, and I afterwards met no one who could give me a reliable account of this river.

One hundred and thirty miles farther on Loon River enters from the east. This river is from eighty to one hundred yards wide. The person from whom I received my information concerning the last mentioned stream had also explored this one for some distance and gave me the following notes: For eight miles there is good canoe navigation, then a rapid half a mile long occurs, at the head of which is a lake about three miles long and one broad, in which the Indians catch many fish. This is called "Rorrie Lake," and some distance above it is another some two miles in diameter, and called "Round Lake" from its shape. Above this again there is a succession of lakes for many days' travel.

Twenty miles above the mouth of the last mentioned stream, Hare Indian River flows into the Mackenzie on its east side. It is about two hundred yards wide at its mouth, and is said to preserve this width for a long distance. The Indians report that this stream rises in a range of hills on the north-west side of Great Bear Lake, but about its navigability I could learn nothing. There was an old Indian at Fort Good Hope who had been up to the head waters of this river several times; but because he saw me taking an observation in daylight, and learned that I could see the stars at that time, he would give no information, saying: "A man who could see stars in daylight could just as easily see the whole river."

Fort Good Hope is built on the east side of the Mackenzie, two miles and a quarter above Hare Indian River, and two below the ramparts. It was originally about one hundred and twenty miles down the river from this point, but was subsequently moved to the Upper Manitou Island, whence it was swept by a flood in 1836. It was then built on its present site. The Hudson's Bay Company has quite a large establishment at this point, consisting of half a dozen houses and some stables. The Roman Catholic Church has a mission here, and their church is said to possess one of the best finished interiors in the country.

Two miles above the fort we enter what is known in the vicinity as the "Ramparts;" though in the more south-westerly part of the country it would be called the "Cañon." Here, for a distance of seven miles, the river runs between perpendicular and occasionally overhanging walls of rock. At the lower end they rise one hundred and fifty feet above the water, but their height decreases as we near the upper end, at which point they are not more than fifty or sixty feet. At the lower end the cañon is nearly a mile wide, but its walls gradually converge until, about three miles up, the width is not more than half a mile, and this continues to the upper end. Sir Alexander Mackenzie when passing through sounded at its upper end, and found three hundred feet of water, which accounts for the fact that, although the cañon is so narrow, the current is not perceptibly increased.

About a mile above the Ramparts there is a rapid when the water is low, but when I passed there was no sign of it. We paddled right over where the worst part is said to be, and noticed nothing but a current somewhat quickened, but not sufficiently so to prevent our ascent with ease. On the east side of the river the rapid is unsafe for small boats during low water, but two-thirds of the way across to the west shore the water is deep and safe. I was told that several travellers, while

passing in boats, have tried without success to find bottom with long poles. The rapid is caused by a ledge of rock extending across the river, apparently the upper edge of the rock through which the Ramparts have been worn. Over this ledge the river simply drops. The Hudson's Bay Company's steamer has not yet encountered any difficulty in passing up and down.

When on his way down the river, Sir Alexander Mackenzie met some Indians some distance above this place. After confidence had been established by means of presents, he prepared to start onward; and, although his newly made friends told him there was great danger ahead in the form of a rapid or cataract which would swallow him and his party without fail, he continued, they following and warning him of his danger. He advanced cautiously into the Ramparts but could hear or see nothing to verify their statements. At last, when through, they admitted that the only bad water to be encountered was now passed, but that behind the island, just below, was a bad spirit or monster, which would devour the whole party. Failing there, the next island below would surely reveal him. From these statements the two islands have received the names of Upper and Lower Manitou, respectively.

In the fall of 1887 a whale made its way up the river to the Ramparts, remaining there the whole season, and before the river froze over it was often seen blowing. At first the Indians were afraid, but they soon became accustomed to the sight, and shot at the whale whenever it approached the shore. In the spring its dead body was beached by the ice on the west shore seven or eight miles below Fort Good Hope, and the Indians used part of it for dog food. I enquired of its dimensions from several who had seen it. They described it as about twice as long as one of their canoes and thicker through than their own height. This would mean a length of from twenty-five to twenty-eight feet. I have often heard it stated that all the channels of the Mackenzie delta are shallow, but the presence of this whale assures us that one of them at least is over six feet deep.

A short distance above the Ramparts a river flows into the Mackenzie on its west side. I saw it only across the river, but it appeared to be about two hundred yards wide at its mouth. All I could learn about it at the fort was that it came from far up in the mountains.

Above the Ramparts the Mackenzie suddenly expands to over a mile in width. The banks, as a rule, are much lower than they are below, while in some places swamps occur close to the stream, something never noticed below the Ramparts.

Twenty-one miles above Fort Good Hope, Beaver River joins on the west, but as I continued on the east side I saw only its mouth, which appeared to be one hundred yards wide. An Indian with me said that it took its name from the number of beavers formerly found on it. This stream rises in the mountains, but does not seem to be of any importance.

Forty-eight miles from Fort Good Hope, Sans Sault Rapid is reached. This, like the rapid at the head of the Ramparts, is all on one side of the river, which is here a mile and a quarter wide. As I went up the west side, and the rapid was on the other, extending but little more than a third of the way across, I cannot say that I saw anything of it. I heard the roar plainly enough, but saw nothing except a swift current. It is caused by a ledge of rocks extending partially across the river. Capt. Bell reports deep water in the channel at the end of the ledge, and the steamer has no serious trouble in ascending. In very low water it is said that this rock is scarcely covered.

A ridge of hills here extends beyond the river from the Rocky Mountains, occasional glimpses of which can be caught from the water. Just east of the rapids above mentioned a ridge extends eastward from the river for some miles. The highest point in the end nearer the river was triangulated, and the height determined as one hundred and fifty-five feet above the water. To the north and east of this are several peaks, but they are scattered and isolated from each other. On the west side of the river the hills are some distance away. The rock of which these hills are composed is limestone, as far as I observed. I saw some specimens of clay iron stone, but not in place.

A mile above the rapids a river called Mountain River flows in from the west. It is from one hundred to one hundred and fifty yards wide, and shallow.

A mile above this again the Mackenzie turns sharply to the east from its southerly direction, and skirts the base of the mountains for six miles. Its course then curves a little to the south, when what might be termed a cañon is entered, in which the river flows for nine or ten miles. The river here averages a mile in width, and is walled on both sides by perpendicular limestone cliffs, rising from one to two hundred feet above the water. On the south side this wall terminates in what is locally known as Wolverine Rock, rising perpendicularly from the water to a height of about three hundred feet. The formation is limestone, the strata of which stand almost on edge, and the water has worn through them in several places, so that one can sail underneath. Above this point the mountains again approach the river for two or three miles, when they suddenly drop almost to the level of the plain. The banks are there clay and gravel, with an average height of from one hundred to one hundred and fifty feet.

Six and one half miles above Sans Sault Rapids Carcajou River empties its waters into the Mackenzie from the west. It is a large river, being not less than four hundred yards wide at its mouth. An Indian with me stated that this stream was very large and very long, the Indians having ascended it for great distances through the mountains. He pointed out the direction of the valley for some distance above the mouth, and it appeared to run parallel to the Mackenzie for a considerable space; then, turning sharply to the west, to enter the mountains. This river seems to be the largest tributary of the Mackenzie below the Liard.

On the evening of Saturday, 21st July, I met the Hudson's Bay Company's steamer "Wrigley" on her way down to Fort McPherson. She had already been down as far as Fort Good Hope, and had returned with the season's furs. Here I got the first news from the outside world since May in the previous year.

Opposite where I met the steamer is a large island in the river, which the officers of the boat and Mr. Camsill, in charge of the district for the Hudson's Bay Company, named "Ogilvie's Island," requesting me to so mark it on my map, as henceforth it would be known by that name throughout the district.

Ten miles below Great Bear River a stream about one hundred yards wide comes in on the westerly side. I saw it only across the Mackenzie, and got no information concerning it.

Four hundred and forty-four miles from Fort McPherson brought us to Fort Norman, which is situated on the east bank of the Mackenzie just above the entrance of Great Bear River. This river is from two to three hundred yards wide at the mouth, with a moderate current, but a short distance up becomes shallow and the current increases. The color of the water is a beautiful greenish-blue, although when I passed, it was somewhat turbid. It is said by those who have been up on the lake that the water there is very clear.

Between Forts Good Hope and Norman the Mackenzie averages much over a mile in width, and islands are so numerous that there are few reaches of the river without them. Hence, the average breadth of actual waterway is probably not over a mile. I never measured the velocity of the current; but it is nowhere strong, and I estimate that it is never swifter than four miles per hour, except at a few points which will be noticed later on.

On the east side of the river, two miles below Fort Norman, a limestone ridge, known as "Bear Rock," rises one thousand five hundred feet above the water, and maintains this height for some distance northward from the Mackenzie.

After we had passed a point some miles below Sans Sault Rapid we could occasionally see the main range of the Rocky Mountains. I tried to locate the most prominent peaks in sight by triangulation, but on account of continuous wet weather during the whole summer I did not succeed as well as I wished, although I continued this work all the way up the river to within a few miles of Fort Simpson. The data thus collected, when placed on my map, will permit an approximate location of the main range for the future maps of the district. In most cases the angular altitudes

of the peaks were noted, so that their heights and positions can both be given. At Fort Norman the mountains are not more than twenty miles distant, but just south of that point they turn away from the river, and are not visible for some distance up.

Above Fort Norman the eastern bank of the Mackenzie is generally high, and composed of clay. The current has undermined these banks in many places to such an extent that they are continually falling into the river. This is markedly the case from twenty to forty-five miles above the point named. The current here is very swift, running in many places as much as eight miles an hour for short distances in passing points.

In 1844 Fort Norman stood twenty-three miles above its present site on the west bank, but when that fort was built I could not learn. During the occupation of this site, one evening the occupants of the fort observed that the water in the river was falling very rapidly, yet retired to sleep, not expecting any danger. Early in the morning they were roused by finding the water in their houses floating them out of bed. They escaped by means of boats, but all their cattle and other property were carried away. It was afterwards discovered that the fall in the water had been caused by an immense land slide damming the waters of the south branch of the Liard River; and the flood, by its release. The fort was then removed to its present site.

Just above the point where this incident occured the river expands into what might be called a lake, only that it is filled with islands, and all the water-ways together probably do not amount to much more than a mile in breadth. This expansion is six miles long and four wide. Above this for six miles the current is very swift, the last mile and a-half of it running fully eight miles per hour. In this portion the current washes the base of a high clay bank on the west side of the river and is continually undermining it, so that it is unsafe to either walk along the bank or sail close to it in a small boat.

Sixty-five miles, by the survey, above Fort Norman, a large river enters from the west. It is shallow at its mouth, as it is throughout its course, according to the reports of the Indians. The current, they say, is swift. They ascend it a long way in the winter to hunt, and descend in the spring on rafts. How far they go up I could not learn, their unit of distance being the unknown quantity of a day's travel, but they go much farther than on any other tributary of the lower river. This is marked on my manuscript map as "Daha-dined River." It was so called by Sir John Franklin, or, rather, the Indians in the vicinity gave him that as the name. I also obtained the name from some Indians who had travelled it, and they called it "Pe-cat-ah-zah." This translated means Gravel River, by which name it is known to all the white men in the vicinity, on account of its shallowness and numerous gravel bars.

Nine or ten miles above, on the same side of the river, another stream enters, apparently not more than a hundred yards wide at its mouth. I saw it from the opposite side of the river only, and heard nothing concerning it. A small stream enters the Mackenzie opposite this place, and up its valley, about two miles from the river, was seen a sharp peak rising one thousand five hundred feet above the water.

About thirty miles farther up on the west side a river discharges a large volume of clear, black water, which sashes bodily half-way across the Mackenzie, and preserves its distinctive character for several miles before it mingles with the main stream. The name applied to this river by the people at Fort Wrigley was "La Rivière le Vieux Grand Lac." It is said to flow out of a lake of considerable extent, lying not far from the Mackenzie. Many peaks can be seen up its valley.

Fifteen miles above Gravel River the Mackenzie changes from over a mile in width, with numerous islands, to a stream often not more than half a mile wide, and without islands. This continues up to Fort Wrigley, except that four miles below the fort it is only three-eighths of a mile wide for a distance of half a mile. The current here is swift, but not as rapid as at some points farther down stream.

Six hundred and twenty-four and a half miles from Fort McPherson brings us to Fort Wrigley. This post was formerly known as The Little Rapid, but has received the name it now bears in honor of the present Chief Commissioner of the Hudson's

Bay Company. Just above the fort there is a swift rush of water over some lime stone rock, which appears to extend across the river. On the west side two small islands confine a part of the stream in a funnel-like channel, which, being shallow, causes a slight rapid, and gives rise to the former name of the post. It is said that this channel is sometimes dry during low water in the winter months.

From La Rivière le Vieux Grand Lac to the fort a range of mountains runs parallel to the river on its east side. They are in many places so close to it that the foothills come down to the water, especially near Fort Wrigley, but just above this point they turn away eastward from the river. Above Little Rapid the river again widens to much over a mile, with numerous islands, and retains this width almost to Fort Simpson. The east bank is generally low and often swampy, but the west, although low for a short distance from the river, gradually rises to a height of seven or eight hundred feet. Fifty-eight miles above Fort Wrigley this hill terminates in a bold, high point, and the ridge turns off to the south-west, enclosing a deep, wide valley between it and the mountains, which here approach the river. This range continues south-eastward out of sight. The positions and heights of some of the peaks were determined by triangulation. One of them was found to rise two thousand eight hundred feet and another four thousand six hundred and seventy-five feet above the river.

Three miles and a half from Fort Wrigley, a stream known to the Indians as the "River Between Two Mountains" discharges into the Mackenzie from the east. Although one hundred and fifty yards wide, it is shallow.

Thirty-nine miles above this, on the same side, Willow Lake River enters. It is a quarter of a mile wide, deep, with a slack current. It is said to flow out of a lake of considerable extent not far from the Mackenzie.

Sixteen miles above this again, on the west side, a river flows in from the south-west. I have seen its name spelled Na-hone, but it is spelled by the Rev. Father Petitot, Na-hauner. This stream, as seen from the opposite side of the river, seems about two hundred yards wide; but it is shallow and rough at the month, as was ascertained by the noise of its waters being plainly heard across the Mackenzie, here a mile wide. I could get no information as to what it was like for any distance above its mouth; but it pierces the range of mountains to the west, which here come close to the river. The valley thus formed can be seen extending south-westerly through the mountains for many miles.

No streams of any size enter the Mackenzie between this point and the confluence with the Liard. The banks in this stretch are alternately low and swampy, and moderately high, consisting of gravel and sand.

By the survey it is seven hundred and fifty-eight and one-half miles from Fort McPherson to Fort Simpson. The latter fort is situate on an island just below the junction of the Mackenzie and Liard Rivers. Above the confluence both streams are apparently of the same size, each being a little under a mile wide. I have no data to calculate the discharge of either; but, if the discharge is in proportion to the area of the drainage basin, the discharge of the Mackenzie would be more than three times that of the Liard. From numerous reports, both verbal and written, it would appear that the Liard may be navigable for light draught stern-wheel steamers up to Fort Liard, which is one hundred and eighty miles above Fort Simpson in an air line. There are places which, in low water, would perhaps be difficult to get over; but they are probably not more frequent than on many other rivers which have been successfully navigated, as soon as the necessity for it has become apparent. Mr. McConnell, of the Geological Survey, came down this river in the autumn of 1887, when the water was probably low, and will be competent to speak conclusively on this subject.

A short distance above the confluence the Mackenzie narrows to an average width of little over half a mile, with a generally swift current. This continues for seventy-five and a half miles above Fort Simpson, and causes this part of the river to be called the "Line," from the fact that large boats cannot be rowed against the current, but have to be hauled by a line attached to them, and pulled by men on

shore. This is the common mode of navigation on all the northern rivers where there are no steamers, as it is less laborious than rowing against a current.

On his way down the river, Sir Alexander Mackenzie sounded near the head of the Line, suspecting from the rate of the current that the water was shallow. On 1st July, 1789, he found fifty-four feet of water here; in a second trial, some distance below, his lead caught in the bottom, and the united efforts of eight men could not pull the canoe against the current far enough to liberate it. In the struggle the line parted and the lead was lost.

The banks of this part of the river are generally somewhat low, consisting of gravel and sand. A couple of small rivers flow in, but are of no importance. Four miles above the Line a stream called "Rivière la Pêche" joins from the south-west, and is from one hundred to a hundred and fifty yards wide. Some Indians I met near its mouth reported it as shallow and rapid a short distance up.

At the head of the Line the river widens from a little over half a mile to a mile and a half, and the banks become lower, rising but a few feet above low water. The current is slow, with almost dead water in the bays. The season of 1888 was unusually wet, and the water in the river and lakes correspondingly high; so much so, that the oldest residents in the district remember nothing like it. The following facts may be cited to corroborate this statement: A short distance above Rivière la Pêche there are large meadows where, formerly, great quantities of hay were cut for the cattle at Fort Simpson. Having looked for, but failed to find these meadows, I inquired as to their whereabouts of some Indians whom I met paddling around shooting along the west shore. They told me that I was then sailing over them. I sounded and found ten feet of water on 4th September, a season of the year when it might be expected to be almost at it lowest summer level. At Lake Athabasca, a man born in the country and now sixty years of age, built himself a house near the Quatre Fourche, some years ago, at a spot where his past experience justified him in expecting never to be troubled by high water in the lake. But 1888 upset all his calculations, for the water in the lake rose so high that it occupied the lower flat of his house, and he had to camp out part of the season.

With the water at this height the flat shores above the Line were all submerged, sometimes for several hundred yards into the woods, so that I found it impossible to carry on the survey in the ordinary manner. I spent two days experimenting to find if I could not continue the accurate instrumental survey by some other method than that heretofore used, but failed. There are no hills in the vicinity of the river, so that a triangulation was impossible, nor could I find any spots on the shore where cutting trees would enable me to continue the micrometer survey, taking longer sights than usual, and using of course a longer base rod. I was compelled above this point to abandon the instrumental survey and carry on a mere track survey, taking compass courses, and obtaining the distances from point to point by the time and estimated rate of travel. I intended to resume the micrometer survey as soon as the height of the water permitted, expecting to find suitable conditions a short distance up. I had been led to expect that I would soon come to higher banks, but I found no dry bank outside the woods until I reached Little Lake, and there only for a short distance. I found the general state of the shores the same all the way to Great Slave Lake, and along it to the mouth of Great Slave River. I was compelled to continue the compass survey to that river, and up it several miles, before the banks were high enough to permit a continuous micrometer survey. Even then much of the instrumental survey was made in mud so soft that frequently one could not stand without sticks under his feet to prevent his sinking.

Before starting the compass survey I determined the latitude of the last micrometer station, and the error of my chronometer on local time, as well as I could with my instruments, intending to check my work as I went along by frequent latitude and time observations. But the cloudy weather prohibited this, and I got on the lake but one partial observation for time and none for latitude. I took some star transits for time while at Fort Resolution, but was unable to determine the chronometer rate during the interval; so that the observations are not of much

value as a check on the distances estimated. There is therefore a break of two hundred and eighty-two miles in my instrumental survey between Forts McPherson and Chipewyan. If the longitudes assigned to Forts Simpson and Resolution on the maps are correct, the error of my compass survey can be discovered by comparing the difference of the longitudes given on the maps with that deduced from the survey.

The banks for the whole of this stretch are very low and swampy, and soil mostly sandy, and covered thickly with willows along the shore.

Twenty-six miles above the head of the Line Yellow Knife River enters the Mackenzie from the south, but as the country was all flooded it was impossible to form an idea of its size without ascending it some distance, which I had not time to do. It would appear, however, from the statements of the native with me, that this is the largest tributary of the Mackenzie between the Liard and Port Providence.

Sixty-two miles from the head of the Line brings us to Little Lake, which is about twelve miles long, and ten or twelve miles wide, being merely an expansion of the river. The southern shores are flat and sandy; but, notwithstanding this, the water when I passed was deep a short distance out. What it is in an ordinary stage of water I did not learn. Sir Alexander Mackenzie reports making frequent soundings in the lake during the last days of June, 1789. In the lake he found eighteen to thirty-six feet of water, and in the river below the lake, to the head of the Line, from twenty-four to thirty-six feet.

Above Little Lake, as far as Fort Providence, the river is wide and islands are numerous. Until I passed this point I followed the north shore, and could nowhere see across, so I can only guess at the width; but it cannot be less than two miles, and is probably three, or more.

Fort Providence is on the north bank of the river, twenty-four miles above Little Lake. At the fort is the usual collection of buildings found at a Hudson's Bay Company's post. The Roman Catholic Church has a mission here. For a few miles above and below the country on the north bank is less swampy than that just passed, the banks being gravelly, and rising fifteen to twenty-five feet above the water. Above the post is a slight rapid, which on the Lewes or most other rivers in our territory would not be noticed, being nothing more than a slight acceleration of the current over a gravel bar. When passing down, Sir Alexander Mackenzie sounded there, and found twenty-one feet of water. Opposite the fort is an island a mile or more long, and distant about half a mile from the north shore. Between it and the north shore the river is shallow, the main channel being on the south side of the island. South of this island is another, quite as far from the first as that is from the north shore, but how far this island is from the south shore I have no idea, nor could anyone at the post tell me definitely.

A little over four miles above the fort the channel is free from islands for some distance, the average width being about a mile and a half. Seventeen miles above Fort Providence the river expands into a small lake, named Beaver Lake, which is from two to four miles wide and eight long. I was informed that quite a large stream, called Beaver River, flows into this lake on its south side. Above this the channel, although continuing nearly as wide as Beaver Lake, is pretty well filled with islands.

Forty-six miles from Fort Providence we enter Great Slave Lake.

Exploratory Survey from Mackenzie River through Great Slave Lake and River to Fort Chipewyan, on Lake Athabasca.

The shore of Great Slave Lake, between Mackenzie and Great Slave Rivers, is low and flat, nowhere in that distance rising more than twenty or twenty-five feet above the water. Most of it is so low that it was submerged when I passed. The soil seen was all more or less sandy, until we reached the vicinity of the delta of Great Slave River, at which point it is a rich, black, alluvial deposit.

About eighty-one miles from Fort Providence, Hay River enters the lake. Around the mouth of this stream the soil is sandy, and the vegetation not so

abundant as in many other places, but some Indians have located here, and built themselves houses. They generally remain at this point all winter, subsisting on fish and a few potatoes which they raise. One old man seemed more provident than the majority of Indians. Some years ago he got a cow from some of the Hudson's Bay Company's people, and has since so managed that he is now the owner of seven or eight head, evincing a great anxiety to increase the number. His example will go far to encourage others to do likewise. There is no reason why the Indians in this district should not sustain themselves, partially at least, by cattle-raising, as there is fair pasturage along the lake, and meadows must be numerous in the flats away from the shore.

Hay River is from one hundred to one hundred and fifty yards wide, but just at the mouth is a large island, which makes it nearly half a mile across. Some eighty or one hundred miles from the mouth is a fall about eighty feet high. Mr. McConnell visited this point, and can give a fuller and more correct description of it than I can, as my information was derived from a few Indians whom I imperfectly understood. Hay River is only forty or fifty miles from the Peace at Vermilion, and the Indians at the mouth told me that they often ascend it and cross over to that point. They say that between the falls and the "Portage," as it is called, there are three bad rapids; but above them, for a long distance, there is comparatively good water.

One hundred and eight miles from Fort Providence we reach Buffalo River. This stream is about one hundred yards wide at its mouth, with an easy current, indicating a comparatively small volume of water. Around its mouth is a prairie, some forty or fifty acres in extent, on which the Indians have built a house, and erected racks for fish drying.

Nine miles beyond Buffalo River the shore line is much indented by shallow bays of small area, bordered by low banks of limestone. In ordinary seasons it is probable that there is little, if any, water in these bays, as there were only a few feet in most of them when we sailed through. The limestone formation is exposed at frequent intervals along the shore for eighteen or twenty miles. At one point it was observed to be so strongly bituminous that a fire built on the rock caused it to emit strong fumes of petroleum.

About twelve miles before reaching Fort Resolution we pass Buffalo Creek, a small river which flows parallel to the Great Slave for more than fifty miles. Travellers to Fort Smith with canoes often follow this stream, as it is much shorter than the crooked and winding Great Slave River.

One hundred and sixty-seven miles from Fort Providence, or one thousand and eighty-three from Fort McPherson, brings us to Fort Resolution, on the south shore of Great Slave Lake, near the mouth of Great Slave River. Here the Hudson's Bay Company has the usual trading-station buildings, and the Anglican Church Missionary Society has a small mission. The Roman Catholic Church also has a mission on an island in the lake, about two miles from the fort.

At the fort I took magnetic observations as well as star transits to determine the error of my chronometer. I then resumed the micrometer survey, hoping to carry it on without interruption to Fort Chipewyan, connecting there with my survey of the Athabasca River. But, after working seven miles from the fort, I found the shore around the delta of Great Salve River so low and muddy that I was forced to desist, and had I to go up the stream some miles before I found ground dry enough to land on. In this place I was unable to get even compass bearings, as the channels of the delta are very narrow and crooked. When I reached a point probably seven or eight miles from the lake I resumed the micrometer survey, this time to carry it through without a break to my survey station at Fort Chipewyan.

From the lake, for more than one hundred and sixty miles, the country along Great Slave River is low, flat, and somewhat swampy, the banks seldom rising more than a few feet above the water. The river throughout this stretch is very crooked; so that the first one hundred and fifty miles from the lake is nearly three times the air-line distance. Its average width is about half a mile, with a current of from three and a-half to four miles per hour, and the river everywhere seemed deep. After-

wards the banks become higher and the soil lighter, and many scarped banks of gravel from thirty to fifty feet high were seen.

A few miles below Fort Smith the banks rise, and the soil is gravelly, with some poplar timber on it. Seven miles below the fort occurs the only rock seen between here and the lake—a very small exposure of limestone. As we approach the fort the banks continue to rise, until at that point a height of one hundred and sixty feet is reached. At the fort the drift, composed of clay, gravel and sand, lies on top of granite rock, which, for sixteen miles up, causes many rapids in the river. This is the head of the run of the steamer "Wrigley," the distance from Fort McPherson being twelve hundred and seventy-three miles.

Fort Smith is at the lower end of a cart road, along the west side of the river, over which the outfits for the posts in the Mackenzie are hauled from the head to the foot of the rapids mentioned above. The Hudson's Bay Company have a few small buildings, and the Roman Catholic Church has a small mission. The surrounding country is sandy and knolly, with small and poor timber.

The survey could not be carried up the river on account of the numerous bad rapids, and was, therefore, made along the top of the bank from point to point. At every station the angles of elevation or depression of the back and fore sights were noted; and from these the differences in elevation were calculated, and the fall of the rapids determined. The distance from Fort Smith to the landing, about a mile above the head of the rapids, is fourteen and one-half miles by the survey line; but as this cuts off two large bends in the river, it is probably two or three miles shorter than the course of the stream. This fourteen and a-half miles follows the main windings of the valley, and is probably slightly longer than the cart road, which cuts across country from one landing to the other. From where my survey left the river to where it reached it again the rise is two hundred and forty-seven feet, of which about two hundred and forty is in the rapids. This seems large, but when we consider the fact that this portion of the river for more than sixteen miles is nearly all rapids, and that the fall is only fifteen feet to the mile, the descent does not appear so great.

All the rock seen in the rapids was granite, with the exception of a small exposure, close to the water's edge, about half way up the rapids, which seemed to be calcareous sandstone, containing many small masses of gypsum.

From the rapids up to Lake Athabasca, east of the river, the surface is much broken by granite knolls, between which lie small swampy flats. No streams of importance enter. On the west side the country is not so much broken, nor are there so many rock exposures. There are a few small outcrops of limestone, much resembling those seen on Peace River at Peace Point, of which they are probably an extension. It appears to me that the river, from the junction with the Peace to the rapids, follows the line of demarcation between the older granitic and newer sedimentary rocks, as nearly all the rock seen on the west side is sedimentary, while on the east no sedimentary rock is noticed. As we approached Peace River some exposures of granitic rock were seen on the west side. But it is low, and covered with drift, nowhere standing more then a few feet above the water, while on the east side the same rock often rises upwards of eighty feet.

Seventy miles above the head of the portage we leave the main river, which above this point is known as the Peace, and follow a small channel locally known as the River de Rocher. Many people call the main river the Peace all the way down to the lake. Often, when speaking of Great Slave River, I was not understood, and had to explain what river I meant. From above the rapids to where we left the main river it is from a quarter to half a mile wide. There are one or two slight rapids, which, however, are not sufficient to interfere with its navigation by the steamer which the Hudson's Bay Company have on it. The rate of the current is not more than three and a-half miles per hour.

River de Rocher does not average more than one hundred and fifty yards wide, and the current is easy. There is one small rapid ten miles above Peace River; but it is not bad enough to prevent the descent of canoes or seriously hinder the ascent of

the steamer. Thirty-eight miles on this channel, after leaving Peace River, brings us to Lake Athabasca, and a little over three miles more to Fort Chipewyan.

On the evening of the 19th October I had completed the survey almost to Lake Athabasca, and was confident of reaching the fort with it during the next day, when the ice which had formed along the shores of the lake was blown out of the bays and carried down the river by the current in such quantities that evening that I became alarmed at the prospect of being closed in before morning, and therefore at once started for the lake. When I arrived there about nine o'clock there was a furious snow storm raging, so I had to remain on the shore until the next morning, when I proceeded to the fort. The weather moderated in a day or two, and I completed the survey on 24th October.

In connection with my survey of the Athabasca and Peace Rivers in 1884 I have already reported on the country around Fort Chipewyan and that end of the lake. As it has been visited by so many others, I need not here say more than that the principal features of the surface are granite knolls and swamps, with some ponds. The timber is pine, spruce, tamarac and poplar.

NAVIGABILITY OF THE VARIOUS STREAMS AND LAKES.

The Hudson's Bay Company's steamer "Grahame" traverses the waters of Peace and Athabasca Rivers, the former from the falls to the rapid at Fort Smith, and the latter up to Fort McMurray. The distance from Fort Chipewyan to the post at the falls on Peace River is two hundred and twenty-two miles. Mr. McDougall, in charge of the Athabasca district for the Hudson's Bay Company, gave me the following notes from the log of the steamer "Grahame," which is capable of steaming about ten miles per hour in still water. In 1888, during the first trip up, the water was very high, the current strong, and much drift wood floating in the river: the sailing time from Chipewyan to the falls on Peace River was sixty-five hours and five minutes; return, twenty-two hours. In 1887, with much lower water, the time going up was forty-nine hours and twenty minutes.

The distance from Fort Chipewyan to the head of Fort Smith portage is one hundred and two and one-half miles. In 1887 the steamer's time from Fort Chipewyan to the landing at the head of the rapids was eight hours and thirty-five minutes; return, eighteen hours and forty minutes. In 1888 the time down was nine hours and thirty minutes, and the return fifteen hours and fifty-five minutes. Mr. McDougall has thoroughly sounded this part of the river and assigns it an average depth of twenty-seven feet. At the landing at the head of the rapids the depth in midstream is one hundred and fourteen feet.

The distance across the lake and up Athabasca River from Fort Chipewyan to Fort McMurray is one hundred and ninety-four miles. In 1887 the steamer's time for this distance was thirty-two hours and twenty minutes going up, and nineteen hours and forty-four minutes returning. In 1888 the time was thirty-three hours and twenty-five minutes up, and seventeen hours down.

I asked Captain Bell, of the steamer "Wrigley," for a statement of the time his vessel took between the various points along the Mackenzie. Just then he had not leisure to take the information from his log, and I had no opportunity afterwards of getting it from him, both of us being too busy to attend to the matter during the short time we were together at Fort Simpson. He told me that the steamer could make ten miles per hour in still water, and that her average speed up stream was six. But it must be borne in mind that in ascending they take advantage of all the easy water possible by keeping close to the shore.

Excepting a short distance at the head of Mackenzie River, where it is doubtful, it is certain that vessels drawing at least seven or eight feet of water can navigate from the delta of the Mackenzie to the rapids on Great Slave River, a distance of one thousand two hundred and seventy-three miles. If the Mackenzie delta also allows that draught, we have about one thousand three hundred and forty miles of navigable water from the rapids to the Artic Ocean.

Some notes as to the time during which this great stretch is open to navigation will serve both commercial and meteorological purposes. At all the Hudson's Bay

Company's posts a journal is kept of all proceedings at the post, and of every event of note in the vicinity. From these journals can be ascertained the dates of the opening and closing of the river at the respective posts ever since they were built. From the officers at Forts Norman, Simpson and McMurray, I obtained data which I here submit. The date on which the ice broke up is given in each case, but, as a rule, the river was not clear of running ice until nearly a week later.

FORT NORMAN—LATITUDE ABOUT 65°.

Year.	Ice Broke Up.	First Snow.	First Ice Formed.	River Closed.
1872	Not given.	September 28th.	October 7th.	November 8th.
1873	May 17th.	do 28th.	do 21st.	do 12th.
1874	do 25th.	October 15th.	November 2nd.	do 18th.
1875	do 24th.	Not given.	October 23rd.	do 9th.
1876	do 19th.	October 10th.	do 13th.	do 9th.
1877	do 12th.	September 25th.	do 18th.	Not given.
1878	Not given.	do 28th.	do 22nd.	November 7th.
1879	May 9th.	October 3rd.	do 29th.	do 2nd.
1880	do 22nd.	do 7th.	do 22nd.	do 12th.
1881	Not given.	do 2nd.	do 7th.	do 12th
1882	May 14th.	do 9th.	do 14th.	do 14th
1883	do 11th.*	do 9th.	do 24th.	do 10th.
1884	do 28th.	Rest of record lost.	——	——
1885	No record.	No record.	No record.	No record.
1886	do	do	October 18th.	November 13th.
1887	May 24th.	September 23rd.	do 5th.	do 8th.
1888	do 19th.			

In the record given below—for that part of the Mackenzie below the mouth of the Liard—it must be borne in mind that the Liard, being a mountain stream and rising in a somewhat warmer climate, opens before the Mackenzie River, which has also the disadvantage of having a large body of still water near at hand in Great Slave Lake.

FORT SIMPSON—LATITUDE 61° 52′ N.

Year.	Ice Broke Up.	First Drift Ice.	River Closed.
1876	May 14th.	November 4th.	November 17th.
1877	do 8th.	do 1st.	do 28th.
1878	do 8th.	October 16th.	do 28th.
1879	do 3rd.	November 12th.	do 20th.
1880	do 7th.	do 2nd.	do 26th.
1881	do 13th.	October 12th.	do 18th.
1882	do 7th.	November 1st.	do 30th.
1883	do 1st.	October 28th.‡	do 20th.
1884	do 12th.	do 11th.	do 18th.
1885	do 2nd.	do 28th.	do 20th
1886	do 13th.	do 30th.	do 25th.

The dates of the breaking up of the ice in the Mackenzie above the Liard for the same years are as follows:—

1876	Not given.	1882	May 20th.
1877	May 19th.	1883	do 5th.
1878	do 17th.	1884	do 14th.
1879	do 19th.	1885	do 7th.
1880	do 19th.	1886	do 27th.
1881	do 19th.		

* River was not clear of ice this year until 28th May.
‡ The first drift ice in the Mackenzie this year was seen November 1st.

The river is always open some time before the lake. In the latter the ice floats around for some weeks before it is sufficiently broken up to pass down the river. In 1888 it was well on in July before the lake was clear enough to enable the steamer to proceed to Fort Smith, but that was an unusally late season. As a rule, I believe, navigation on the lake opens in the last days of June. At Fort McPherson, on Peel River, the ice does not generally leave until the 1st of June. On Lake Athabasca the ice goes a little earlier than on Great Slave Lake; but this does not affect the question of the navigability of the Mackenzie, which cannot be reached until Great Slave Lake is clear.

At Fort McMurray, situated at the foot of a long series of rapids on the Athabasca River, I obtained the following notes of the breaking up, drifting, and setting of the ice. This point is in about latitude 56° 40′.

Year.	Ice Broke Up.	First Drifting Ice.	Ice Set, River Closed.
1878	April 18th.	October 27th.	No record.
1879	No record.	do 26th.	November 1st.
1880	May 2nd.	November 14th.	No record.
1881	April 21st.	October 14th.*	November 12th.
1882	do 24th.	November 1st.	do 8th.
1883	do 25th.	October 30th.	do 10th.
1884	do 27th.	do 18th.	October 28th.
1885	do 9th.	do 23rd.*	November 13th.
1886	do 16th.	November 4th.	do 14th.
1887	do 27th.	October 22nd.	October 24th.
1888	May 4th.	November 3rd.	November 9th.

During the last two years the Hudson's Bay Company has had another steamer, the "Athabasca," plying on the Upper Athabasca River, between Little Slave River and Grand Rapids. Both this steamer and the "Grahame," on the lower river, are flat bottomed stern-wheelers, drawing, when loaded, not more than two and a half to three feet of water. They can each carry about one hundred and forty tons.

I subjoin a table of distances between Fort McPherson, on Peel River, and Fort Chipewyan. The figures given are corrected for all known errors; but that part of the survey which was made by compass and estimated distances, I have no means of correcting at present.

TABLE OF DISTANCES FROM FORT MCPHERSON.

	Miles.
Mackenzie River proper	32·1
Red River	60·1
A large river entering on the east side, name unknown	120·5
Loon River	250·8
Hare Indian River	272·4
Fort Good Hope	274·7
Ramparts	283·6
Beaver River	295·7
Sans Sault Rapids	322·7
Mountain River	323·3
Carcajou River	328·0
Great Bear River	444·0
Fort Norman	444·2
Gravel River	509·3
Riv. le Vieux Grand Lac	550·5

* In these years the river became clear of ice for some time, after which drift ice again appeared, until finally the ice set and closed the river.

	Miles.
Fort Wrigley	624·5
River between Two Mountains	628·0
Willow Lake River	667·0
Ne-hauner River	683·3
Fort Simpson	758·5
Head of Line	829·5
Yellow Knife River	855·6
Little Lake	892·0
Fort Providence	916·0
Great Slave Lake	962·0
Hay River	997·0
Buffalo River	1,024·0
Buffalo Creek	1,071·0
Fort Resolution	1,083·0
Fort Smith	1,273·5
Head of Rapids	1,287·5
Peace River	1,358·9
Fort Chipewyan	1,390·0

The upper Peace River is navigable for steamers drawing three or four feet of water; and, with a little improvement at two points, a draught of five or six feet could be utilized. This upper Peace River affords a navigable stretch of five hundred and fifty-seven miles, which, with two hundred and twenty-two miles on lower Peace River, and two hundred on Lake Athabasca, and, say, two hundred on the lower Athabasca, together with the distance given in the above table, gives us two thousand five hundred and sixty-nine miles of navigable water.

From our present knowledge, meagre as it is, I think we may assume that Great Slave Lake affords us at least five hundred miles more, considering its length and its many deep bays. To this we may add two hundred and forty miles on the Liard, and at least sixty on Peel River, thus making a grand total of three thousand three hundred and sixty-nine miles of water in the Mackenzie basin, all navigable, except for eighteen miles, at but two points, one a rapid two miles long on Peace River, and the other the Sixteen Mile Rapid on Great Slave River. A thorough knowledge of the two great lakes with all their tributary streams would probably increase this vast length of navigable water by several hundred miles. This does not take into account the Mackenzie delta and the sea near its mouth, of the navigability of which nothing very definite is known at present.

During July, August, and part of September, I kept a record of the rise and fall of the water in the river during the hours when I was not travelling. In the evening, when camp was made, a mark was set at the level of the water, and in the morning, the rise or fall was noted. Of course I could not observe the change during the day hours when I was moving. My object was to find approximately when the water fell to its lowest stage, as well as the rate of fall. But, owing to the very wet season, the rate thus determined does not indicate the variations of the water in ordinary seasons. On the lake I kept no record of the rise or fall, as the observation would have been difficult, owing to the surf continually beating on the shore. Such a record would be of very little utility, as the depth changes with the direction of the wind, the water being often several feet higher on the shore upon which the wind is blowing than on the other. I found the high water not only a great hindrance to the progress of the work, but also the cause of much additional hardship.

TIMBER RESOURCES.

On the lower Mackenzie, as on the Lewes, the timber large enough for commercial or manufacturing purposes is all in the river valley. On the plains above, the trees are small and unfit for anything except for fuel or the few uses to which trees six or eight inches in diameter can be applied. There is some fine material for

lumber on some of the islands in the river, but many are bare, with the exception of a few willows. It may, in short, be said that, away from the immediate vicinity of the river, there is no timber of value in the sense in which the term is used in the east, until we get above Fort Wrigley, and then in some places the banks are low, flat, and swampy, with trees much larger than those on the higher lands, many of them being fit to make fairly good lumber. On the flats between Fort Simpson and Great Slave Lake, as well as on those adjoining the lake, there is also much forest that would yield a large amount of good sized spruce and poplar.

The level country surrounding the lower half of Great Slave River is all well timbered with fine large spruce, equalling in this the lower Athabasca and Peace Rivers, and I think, when the time comes, that here will be found this district's principal supply of lumber. On the high, light soil around Fort Smith the trees are small, and generally of no value, except for fuel. Along the river, between the rapids and Lake Athabasca, there are many small areas of flat, swampy ground, which would supply some very fair timber.

It may be said generally of the lower Mackenzie that the timber along it is only sufficient to supply the needs of the immediate vicinity. On the upper river the surplus is not sufficient, and the market is not convenient enough to justify manufacturing until existing conditions are greatly altered.

The varieties of trees along the lower part of the river are few, spruce, with a few small tamarac, some small birch, and a few poplar, constituting the bulk of the forest. The spruce far outnumber all the rest. On some of the islands there is much shrubbery, willows and alders growing in profusion in the swampy places; but, in general, the undergrowth is stunted and thin, especially on the uplands.

AGRICULTURAL CAPABILITIES.

Everywhere the Mackenzie basin is quite as capable, so far as quality of soil is concerned, of supporting an agricultural population as the greater part of the Provinces of Ontario and Quebec. The soil as seen from the river is generally good; and the probability is that it continues so at least as far back from the stream as the woods extend. This extent is said to vary from twenty to forty miles on the east side, where no stream flows in, but, where there are streams, the distance is much greater as the timber follows the valleys. Beyond the fringe of timber we come to the so-called barren lands, on which nothing but mosses and lichens grow, and which, except as the pasturage of the musk ox and a few other animals, are practically useless as far as known at present. On the west side of the river the woods extend to the timber line on the mountains.

Assuming the limits to be as above, the area of the fertile soil can readily be found. Speaking only of that portion of the Mackenzie basin extending from Athabasca Lake to the Arctic Ocean, we have a strip of land nine hundred and forty miles long and something over sixty wide. This gives in round numbers sixty thousand square miles of land, the agricultural capabilities of which we may reasonably discuss. I think the above area is less than that actually wooded, but on the west side much of the surface is probably at such an elevation, being near the mountains, as to be outside the limits of our discussion. Theoretically the points involved are the prevalent temperatures during the growing months, the period of vegetation, and the duration of sunshine.

I do not know of any regular record of temperature having been kept at Fort McPherson, the most northerly point at which any one is permanently settled in the district. The only information on this point which I have is my record for the last ten days of June while I was camped in the valley near the fort. The lowest temperature during that period was 37°·3 F. on the 20th, and the mean minimum from the 20th to 30th was 43°·3 F. The highest observed temperature during the same period was 74° F. at 1.30 p.m. on 21st June, and the mean temperature at that hour for the ten days was 62° F. The lowest of these temperatures would not injure vegetation. The mean minimum for the whole month would be below this, probably two or three

degrees, but even that would not arrest vegetable growth. When, in connection with the temperature, we consider the number of hours of sunshine during June and July, it seems evident that Fort McPherson has all the essentials for the successful cultivation of most cereals and vegetables. At this northern point refraction extends the time during which the sun does not set, so that there are twenty-four hours sunshine each day from about 1st June to 15th July. On 1st May the sun is up for seventeen and one half hours, and during August the hours of sunlight vary from nineteen on the 1st to fifteen on the 31st. The total hours of sun are seven hundred and six in May; seven hundred and twenty in June; six hundred and eighty-four in July; and five hundred and twenty-seven in August—in all two thousand six hundred and thirty-seven hours of sun out of the total, day and night, of two thousand nine hundred and fifty-two in the four months. As twilight continues while the sun is less than eighteen degrees below the horizon, there is actually no darkness during this period. When the temperature is suitable, vegetation under these conditions thrives to an almost incredible degree, as the following shows: When I arrived at Fort McPherson on 20th June the new buds on the trees were just perceptible, and on the evening of the 22nd the trees were almost fully in leaf.

The mean minimum temperature for the month of July was 45°·4 F. The mean temperature for 1.30 p.m. was 64°·7 F., but on two occasions the thermometer went to 78° in the shade, and ten times to 70°. These temperatures were noted along the river, at different points of course, although during the greater part of the month my latitude did not change very much.

This combination of favorable temperature and long hours of sunlight promises well for vegetable growth, but there are interfering causes. Unfortunately snow storms are apt to occur at any time in the year at Fort McPherson. On 2nd July five inches of snow fell and the thermometer went down to 25° (7° below freezing point); yet, strange to say, the frost did not appear to hurt anything. A north-east wind, continuing for a day or more, lowers the temperature in a few hours from pleasant summer heat to what reminds one of the approach of winter.

As far as I could learn, no attempt at cultivating cereals or roots has been made at Fort McPherson. But at Fort Good Hope some of the people grow potatoes and other garden produce; and, as the difference of latitude is not much over a degree, the same things ought to grow nearly as well at Fort McPherson. The potatoes grown at Fort Good Hope are small, averaging about the size of large hens' eggs. Those which I tasted were bad, as if they had been frozen; but they were of the previous season's growth, and it was then the middle of July. Even in Ontario potatoes of that age are not very palatable. This tuber appears to have always vitality enough to increase, as at Fort Good Hope they have had no change of seed for several years. This tends to show that the frosts are not very severe during the time the potatoes are growing and ripening. When I passed, the onions, lettuce, and other things planted in the gardens, were pretty well advanced, the onion stalks being about as large as pencils. No cereals had been sown, but I think barley would succeed fairly well. I am not aware of any continuous record of temperature at Fort Good Hope; so I cannot say whether the climate at that place is suitable for the growth of plants during June, July and August. While I was there the days were pleasant and warm and the nights not unpleasantly cool. Nor, if we omit the 2nd of July, when snow fell, did I note anywhere any temperature below freezing during July and August.

It may be said that my observations extended over too great a range of latitude to be of any value in indicating the temperature at any period or any place, as, while they were being taken, we were constantly moving south. This is true. But it must be remembered that in moving south we were leaving the area of constant sunlight and getting to where night has a cooling effect, so that the objection has not the same weight it would otherwise have.

The statement given below of the duration of sunlight in the months of May, June, July and August, serves to show that a difference in latitude has not the same effect in changing the summer temperatures of places in high latitudes as it has in more southerly localities. Unfortunately, the records at posts in the district are

too few and meagre to either confirm or disprove this theory, and to use the records of such places as Fort Franklin, on Great Bear Lake, and Fort Rae, on Great Slave Lake, is hardly fair. These points are over three hundred miles apart in an air line, and the temperature at either or both may be influenced by the local conformation of the ground, or rather unknown causes. However, taking the records at these places, we have the following comparison:—

Mean Temperature during	Fort Franklin, lat. 65° 12′	Fort Rae, lat. 62° 40′
May	35° ·2 Fah.	27° ·7 Fah.
June	51° ·4	51° ·4
July	52° ·0	61° ·2
August	50° ·6	56° ·5

The Fort Franklin data are given in Professor Loomis' Meteorology, published in 1875. He gives as his authority Dove's tables in the report of the British Association for 1847. Who the observer was is not stated, but it was probably Franklin. The Fort Rae statistics were furnished by Mr. Carpmael to the Senate Committee appointed to inquire into the resources of the Mackenzie basin, and cover the same months as those given for Fort Franklin. These statistics, as far as they go, confirm the theory, for the extremes at Fort Franklin differ 16° ·8, while at Fort Rae the difference is 33° ·5, and the monthly differences at the former place are much less than at the latter.

I have computed the following table which shows comprehensively the different durations of sunlight for the latitudes of Ottawa and Forts Chipewyan, Simpson, Good Hope, and McPherson:—

—	Ottawa.	Chipewyan.	Simpson.	Good Hope.	McPherson.
Latitude	45° 26′	58° 43′	61° 52′	66° 16′	67° 26′
	H. M.	H. M.	H. M.	H. M.	H. M.
Hours sunlight, May 1	14 08	15 34	16 65	17 06	17 30
do June 1	15 16	17 36	18 39	21 04	24 00
do do 21	15 30	18 44	19 14	22 48	24 00
do July 1	15 24	18 36	19 02	22 04	24 00
do August 1	14 32	16 16	16 56	18 16	19 24
do do 31	13 08	13 52	14 08	14 36	14 44
	HOURS.	HOURS.	HOURS.	HOURS.	HOURS.
Hours sunlight in May	456	514	538	592	706
do June	462	549	570	662	720
do July	464	530	558	625	684
do August	423	467	481	519	527
Totals	1,805	2,060	2,147	2,398	2,637

The number of hours of sunlight in each month has been obtained from the mean of the numbers at the beginning and ending of the month. This does not give a strictly correct result, as the sun's declination, on which the length of the day depends, does not change uniformly, the daily change in June, when the sun has attained its greatest declination, being small as compared with that in September, when the sun is near the equator. Were the light of each day in the period separately computed the totals would show even more difference in favor of the north. In computing the above table, refraction has not been taken into account, except in the case of Fort McPherson. Allowance for refraction would increase the duration of sunlight at all the other places; but much more in the north than in the south. As the table now stands it assigns to Fort McPherson eight hundred and thirty-two

hours, or thirty-four and two-thirds days more sunlight than Ottawa during a total period of two thousand five hundred and fifty-two hours. A better mode of comparison is to reduce the number of hours of sunlight at each place to days. It stands thus: Ottawa, seventy-five days, five hours; Fort Chipewyan, eighty-five days, twenty hours; Fort Simpson, eighty-nine days, eleven hours; Fort Good Hope, ninety-nine days, twenty-two hours; Fort McPherson, one hundred and nine days, twenty-one hours—and this out of a total of one hundred and twenty-three days.

At Fort Norman the Hudson's Bay Company had a garden planted with turnips, potatoes, and other garden produce. I was at that point during the last days of July, at which time potato vines were from six to ten inches long, and did not promise a good yield. The Roman Catholic Mission had two patches, together about an acre in extent, planted with potatoes. The soil here was much better than in the first patch, being a warm clay loam, while in the other it was nearly all decaying vegetable matter, commonly called "muck." The mission potatoes were much stronger in the vines than the Hudson's Bay Company's, and, at that time, nearly covered the ground. The Anglican missionary had planted a smaller piece of ground near the river on a sheltered bench below the top of the bank and facing the south. Here the growth was much stronger than at either of the other places. Some barley had been sown in it and was well grown, the stalks averaging from two to two and a half feet high, and the heads being long and just beginning to fill. The growth of grass on this flat is luxuriant, and nettles grow as strong and large as any I have seen elsewhere. Near the edge of the woods wild vetches grow as long and vigorous as they do near Edmonton. Everyone complained of the cold, wet weather which prevailed during the summer and much retarded vegetation. The Roman Catholic missionary, in charge of the mission here, told me that in twenty years' residence at the place he did not recollect such a cool, damp, cloudy summer.

At Fort Wrigley some slight attempts had been made at cultivation, but I do not consider them a fair test of the capabilities of the place. When I was there, on 15th August, the people were gathering blueberries, then fully ripe and as large and well flavored as they are in Ontario. Ripe strawberries were found on 9th August ninety miles below this, and a few raspberries soon afterwards. Above Fort Wrigley wild gooseberries and both red and black currants were found in abundance, some of the small islands being literally covered with the bushes. The gooseberries were large and well flavored, and the currants would compare favorably with the same fruit as cultivated in the vicinity of Ottawa, the black currants being especially large and mellow. This was in the middle of August, in latitude 63°.

At Fort Simpson the Hudson's Bay Company has a large plot of ground planted with potatoes, turnips, onions, and other garden produce, such as is generally grown without artificial means in Ontario. On 24th August when I visited this place the growing vegetables looked almost as good as the same kinds seen on the Ottawa market at the same date. Lettuce particularly was very large and fine. There was also a large area of barley, which looked well and promised an abundant return if allowed to ripen. The grain was then full and plump and just beginning to harden; but fears were entertained that a frost might come and spoil it. The people there claimed that the prevailing cool, cloudy weather had retarded its growth, as otherwise it would then be out of danger from frost. This cereal has been grown with success at Fort Simpson for many years. I understood that wheat had been tried, but with indifferent success. The garden altogether presented an appearance hardly to be expected at a point eleven hundred and fifty miles farther north than Ottawa. It is situated on an island in the river, and the presence of the large body of water may moderate the climate and account for the fine appearance of the garden. Whether the same favorable result can be attained a mile or more away from the river can only be decided by trial. I am strongly of the opinion it cannot.

On the high river bank below Fort Providence wild gooseberries and currants were very plentiful, though on the 8th of September they were somewhat over ripe.

At Fort Providence the usual garden produce is grown every year and generally turns out well. Barley is also grown with success; but in 1888 it was, as every-

where else in the valley, much retarded by cool weather. Up to my departure from the post, the lowest temperature, exclusive of 2nd July, was 31°·8 on 29th August. The mean minimum for the month of August was 43°. When I was at Fort Providence the barley was beginning to change color, and, unless a very severe frost came soon after, would ripen. Wheat has been grown here for many years by the Hudson's Bay Company, generally being fairly ripe before it is touched by frost, and sometimes escaping altogether. The wheat is ground in a small hand mill, and the flour used in the ordinary way by the people of the fort. While there I ground a few pounds of the crop of 1887 and had the flour made into a cake, which, though not quite so good as that made from XXXX flour, was palatable, and would probably sustain life as effectually as any other, those using it appearing as well and strong as could be desired. I brought home a sample of this wheat for your inspection.

At Fort Resolution the Hudson's Bay Company were growing potatoes, turnips, and barley. The first two were of good quality and size; but there would be no yield of the last. The Anglican missionary also had a garden in which were potatoes, cabbage, cauliflowers, turnips, onions, and peas, the latter still green on 21st September. The potatoes and cauliflowers were both good in size and flavor. I was informed that small potatoes were grown in a garden at Fort Rae, situated on a long arm of Great Slave Lake; but, according to report, there is not much land around the lake available for farming, even were the climate suitable, as it is nearly all rock. At Fort Smith nothing of importance from an agricultural point of view had been done and the autumn frosts were very severe.

Samples of seeds from the Central Experimental Farm were received at all the posts, but too late for planting in 1888. If proper attention is given to them, as I believe it will be at most points, the results will be very interesting and instructive as a practical test of the capabilities of the country.

In conclusion, I may say that I do not wish to be understood as representing this country as suitable for agricultural operations, as I do not think it is. I have merely presented the results of the attempts that have been made. These results are doubtless much more favorable than might be expected; but how far they would hold good elsewhere than in the immediate vicinity of the river is not known. It is probable that the presence of such a large volume of water, with a temperature of about 55°, has a beneficial influence on vegetation.

Before that part of our territory will be required for settlement there will be ample time to determine by experiment exactly what it is worth for agriculture. In looking over the world for countries lying in the same latitude to compare with it, we find Norway extending from latitude 58° to 70° 30′, with an area of one hundred and twenty-three thousand two hundred and six square miles, and a population of one million eight hundred and six thousand, nine hundred. Of her territory only about one-thirtieth is under cultivation, one-fourth being covered with forest, and the rest barren mountain land. But as Norway is exposed throughout its whole length to the Atlantic Ocean, the comparison is hardly apposite. Better suited for comparison is that division of Russia known as Finland, lying between 60° and 70° north latitude, with an area of one hundred and forty-four thousand two hundred and fifty-four square miles, and a population of two million one hundred and forty-two thousand and ninety-three. This shows us that we must not regard the district as altogether useless nor despair of its ultimate occupation to at least the same extent as the countries named. When we take into consideration also the adaptability to settlement of the Athabasca and Peace River valleys, which are parts of the same great drainage basin, we may look forward with confidence to its ultimate occupation by several millions of inhabitants. As I reported on the Athabasca and Peace country in 1884, I will content myself here with quoting from the report an extract relating to the agricultural capabilities of the district drained by these two rivers.

"All the way down the Athabasca to the lake the country is (with the exception of a few meadows) thickly wooded, and a great deal of it is swamp and marsh, interspersed with lakes and ponds.

"A great deal of the soil along the bank is of very fair quality. At Fort McMurray are a couple of small prairies or meadows; the soil is good, and the root crops and garden produce raised there are generally very good.

"To convert this into an agricultural country, the forest would first have to be cleared, and considerable drainage would be required for a large portion of it, which would render the question of its settlement a problem for the future to determine.

"From Lac La Biche to McMurray is a pack trail, which is occasionally used. It follows the course of Athabasca River, at a distance of about two to twenty miles. Those who have passed over it inform me the country is much the same as that seen along the river—woods and swamps, with a large percentage of marsh or bog; also quite a number of lakes.

"The country on the west side of the river, as far as I could learn from Indians and the few white men with whom I came in contact who had been over it, was much the same, at least for fifteen or twenty miles back. I could learn nothing definite about anything much farther back than that. The only approach to prairie along the Athabasca is where House River flows into it (a few miles above Grand Rapids), at which point an extensive fire has almost cleared away the forest for a mile or two. It is now covered with a good growth of grass and shrubbery. The soil appears to be very fair—a loamy clay—and were there any inducements to settlers, a few fine farms might be established. A meadow near McMurray is about sixty acres in extent, from which the Hudson's Bay Company procure their hay. The soil is said to be good.

"At a point called 'Point Brule,' about ninety-six miles below McMurray, fire has partially cleared off the forest for some little distance from the river. A couple of families of Chipewyan Indians have taken possession of a small portion of it, and done a little cultivation in the way of planting potatoes. Their efforts were necessarily very crude, and the appearance of the crop bore witness of it.

"It is a pity such attempts do not succeed, as one failure does more to dishearten the natives with agriculture than ten successes would do to encourage them.

"The soil at this point was gravelly clay, and, with ordinary cultivation, should yield pretty fair crops.

"On the flats near the lake the soil is wholly alluvial; it is rich, but too low and damp for agricultural purposes.

"On the north side of the lake, around Chipewyan, there is little or no soil of any description, the country being all bare Laurentian rock.

"The Hudson's Bay Company have a garden at the fort of upwards of an acre in extent, and the Episcopal Mission one of smaller area, but the soil is very sandy. The Roman Catholic Mission have a garden also, most of which they obtained by draining a bog.

"In the season of 1883 (which was a favorable one in that district, being free from summer frosts) the Hudson's Bay Company raised about four hundred bushels of potatoes, the Episcopal Mission thirty bushels on a small patch, and the Roman Catholic Mission about five hundred bushels.

"Many of the retired Hudson's Bay Company's servants also have small patches which they cultivate; potatoes and fish being the principal articles of food used during the winter.

"I am sorry to say that owing to the prevalence of summer frosts, nothing like the above returns were expected by any of the parties above named last summer.

"I believe one or two of the patches owned by Hudson's Bay Company's retired servants escaped the frost, but the general effects were ruinous.

"Ascending Peace River until Peace Point is reached, the country is mostly low and flat, with many lakes and ponds, like that on the Athabasca. Occasionally a sandy or gravelly ridge is seen, which must have formed a bar in the shallow waters of the great lake which once covered this district. The soil on the flats is good, but, like that on the flats of the Athabasca, it is too low and damp for agricultural purposes. On the north side of the river at Peace Point the country is prairie, with poplar bluffs; and the same extends, I was informed by Indians,

through to Salt River, in the Great Slave Lake district. The soil along Peace River at this point is a black, gravelly clay, with a coarse gravel subsoil; and, as nearly as could be learned from the Indians, it is pretty much the same all the way through to Salt River, where there is quite an extensive prairie. This prairie was described to me by those who have seen it as one of the prettiest and best pieces of country in all the northern district. The country along the north side of the river, from Peace Point up to Vermilion, is generally heavily timbered, with occasional parts of open scrubby woods and small patches of prairie. On the south side the open woods and prairie are less frequent, until we reach a piece of scrubby prairie, which begins seven or eight miles below Red River, and reaches to it, and runs back about two and a-half or three miles, where it merges into the forest. The soil in it is good black, loamy clay, about one foot deep, with a subsoil of fine sandy clay. The Hudson's Bay Company here cultivate two or three acres, and when the summer frosts are not too severe the returns are splendid. This year the crop consisted of potatoes, turnips, and garden stuff, which, notwithstanding the successive and severe frosts of the season, looked very well when I was there (the 22nd August), but Mr. McKenzie feared the yield of potatoes would be small compared with that of last year, which was enormous. Usually a little barley and wheat has been grown there; this year none was sown.

"At Vermilion, along the river on the south side, there are about twelve to fourteen miles of prairie, with small poplar and scrub, which runs back from the river about three miles. The soil is good black loamy clay, loose and deep, with a gravelly clay subsoil. The Episcopal Mission school at Vermilion, for the teaching of the young in the district, has a farm attached with about twenty acres under cultivation, under the management of Mr. E. J. Lawrence. Last year his crops of potatoes, barley and wheat were splendid; this year the frosts almost destroyed everything.

"Mr. Garrioch, in charge of the mission, also cultivates quite a large piece, from twenty-five to thirty acres, in connection with the mission. The Hudson's Bay Company has an extensive field growing both roots and grain, (wheat and barley); and the Roman Catholic Mission also cultivates some ground. Besides the above farms, several others were located last summer by private parties, all of whom seem hopeful for the future. Many of them had been in the country for several years. Here, as at other places mentioned, no one expected to harvest much more than the seed sown, owing to the very unusual season, which was in the early part dry and warm, so that grain sown in April did not germinate until June for want of moisture. In June the weather became very wet, and continued so all the summer, with frosts at frequent intervals. That this summer was unusually severe all were agreed, but all admitted that there was an uncertainty every year. Mr. Moberly in charge of the Hudson's Bay Company's post here, who had lived in the country for several years, told me his experience for seven years stood as follows: Two years an unqualified success, two years failure such as the present, and three years a fair return.

"Opposite Vermilion, on the north side of the river, there is an extensive tract of prairie and poplar bluff country, which extends from the Peace to the watershed between Peace and Mackenzie Rivers south-westward along Peace River for about forty miles or more, and north-eastward along the river a few miles, until it merges into the country already described. This is said to be a first class country in every way, well wooded and watered, with a rich, deep, black, loamy soil; and if the life of flowers and berries be an indication of freedom from frost this district is favored in this respect, as the berries ripen here when they are killed in the surrounding parts.

"The country south-westward from the end of this tract to Battle River is described as woods and swamps, alternating with patches of prairie and open woods, and from Battle River to the prairie near Dunvegan is generally drier, with more prairie.

"It appears, therefore, that from Dunvegan, on the north side of Peace River, down the river to Peace Point, and thence to Salt River, on the Great Slave, there is a tract of country about six hundred miles in length and forty miles wide of which

a large precentage is fit for immediate settlement, and a great deal more could be very easily cleared.

"Of the country south-east of the Peace, between it and the Athabasca, very little is known. It was described by all whom I met, who had seen any portion of it, as a rolling surface, the ridges heavily wooded with fair timber, and many of the basins containing swamps and lakes of considerable size. Out of one of the latter, Lake Wapisca, Loon River flows into the Peace, and another stream called by the same name into the Athabasca at Grand Rapids. Some of the ridges rise into high hills, and in some of these rock exposures are said to be visible. Whenever the needs of the country make it worth the trouble, timber can be easily floated into Athabasca and Peace Rivers by the numerous streams which enter them from this tract.

"A little north-east of Vermilion, and between twenty and thirty miles from the river, is the west end of Cariboo Mountains. They extend from this point eastward about sixty seven miles, and then appear to turn to the north. From a station a little below Vermilion I took the angle of elevation of the highest point I could see in them, and found it to be 0°.55′, so that they must rise between one thousand five hundred and two thousand feet above the river. I saw no white man who has been in these mountains, except on a flying visit in the winter for trading, and then, of course, the most rugged parts would be avoided, and consequently very little observed of the rocks composing them. The Indians speak of beautiful many-colored stones seen in them. Judging from what they say, I think the rocks are Laurentian, and the 'beautiful stones' may be crystals. I was told they also speak of places on the north side of the mountains which smoke in the winter; but I have noticed that the Indians call all sorts of vapours 'smoke,' and what they call smoke may only be the vapour rising from springs.

"At Dunvegan, notwithstanding the severity of the frosts, the crops are very good both in quality and quantity. When I was there the Roman Catholic missionaries had threshed their grain, samples of which I brought back. The yield was as follows:—Fifty pounds of wheat were sown on the 16th April and reaped on the 20th August, and twenty-seven bushels threshed of good clean grain; fifteen pounds of Egyptian barley sown on the 18th April and reaped 20th August, and fifteen bushels threshed, weighing fully sixty pounds to the bushel. The Hudson's Bay Company and Episcopal Mission had not threshed, and could not give their returns; but they were well satisfied with their crops of all kinds. The Rev. Mr. Brick, of the Episcopal Mission, was already using bread when I was there made from wheat of the present year's growth.

"The only settler in all the Peace River country who lives beyond the immediate valley of the river (Mr. Milton, about eleven miles from Dunvegan), lost all his crop by the frosts, fortunately for him, his operations were not very extensive. A company was formed last season, by people interested in that part of the country, to erect a small grist mill in order to encourage settlement there; but the unusual severity of the season caused them to recall the order they had already sent out for the mill. It is much to be hoped that next season will prove more favorable; should it not, it will divert a good deal of attention that is now directed to that part of the country, and of which (aside from the climatic conditions) it is in every way worthy."

FISH.

Fish are numerous in the Mackenzie, the principal species being that known as the "Inconnu." Those caught in the lower river are very good eating, much resembling salmon in taste, being also firm and juicy. The flesh is a light pink in color, but as they ascend the river and become poor, this tint turns white and the flesh gets soft and unpalatable. They average ten or twelve pounds in weight, but have often been caught weighing thirty or forty. They ascend as far as the rapids on Great Slave River, where they are taken in the fall in great numbers for dog-feed, being then so thin that they are considered unfit for human food, if any-

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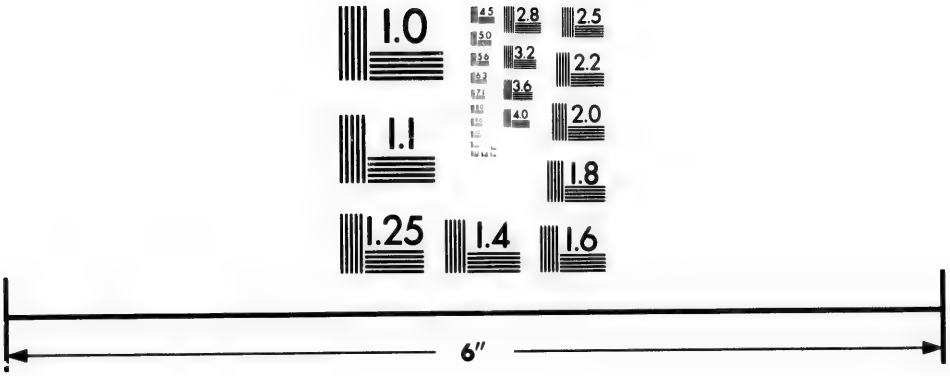

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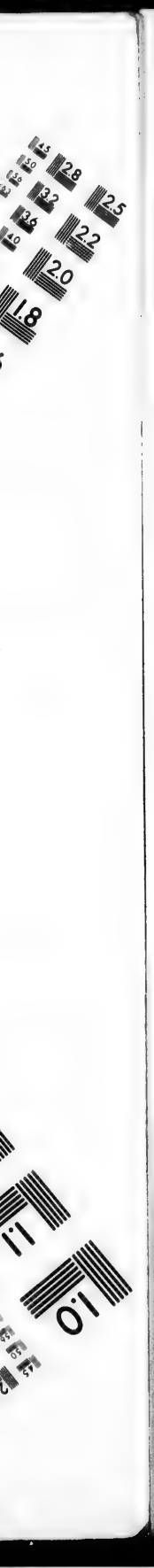
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thing else is obtainable. This fish is not fed to working dogs, unless scarcity of other fish compels it. There is a small fish known locally as the "herring," somewhat resembling the Inconnu in appearance, and which does not grow larger than a pound or two in weight. The staple fish of the district, and, for that matter, of the whole North-West, is the whitefish. They abound in many parts of the river, but especially in all the lakes discharging into it, and form the principal article of diet during the greater part of the time, as very little food is brought into the country. This fish is caught in large numbers everywhere. At Fort Chipewyan, the Hudson's Bay Company, in the fall of 1888, required thirty-six thousand for the use of the post; the Roman Catholic Mission, twelve thousand; and the rest of the population, at least thirty thousand more. Most of these were caught within three weeks, while I was there. Sometimes they are numerous in one place, and sometimes in another, so that long journeys are often necessary from the place where they are caught to where they are to be used. This necessitates a large number of dogs to haul them home, which is a very poor method, though the only one in use. To overcome this inconvenience Mr. McDougall, at Chipewyan, has built an ice-boat, but has so far met with indifferent success, as the ice has been unusually rough during both of the last two falls.

FURS.

As the trade in furs is pretty well known and understood throughout the country, it is not necessary to say very much about it here. I have no statistics to offer in connection with it, other than can be derived from published reports on that section of the country. The pelts obtained in the district are essentially the same as those obtained in the rest of the territory, with the addition of the musk ox, the Arctic or white fox, and the blue fox, the first being found only on the barren grounds east of the river and north of Great Slave Lake, and the last two down near the Ocean.

The labor attendant on bringing the skin of the musk ox from the barren grounds where it is killed is great, compared with that connected with securing other pelts; and this will to a certain extent protect them from the undue slaughter which has resulted in the extermination of the prairie buffalo. An Indian gets a little more for a musk ox skin than for a marten pelt, yet he can bring a hundred marten pelts to market with less labor than one ox skin. If he travels far into the barren lands after them, he has so much farther to bring the skin back. So there is a limit he cannot conveniently pass, and beyond this the ox will be unmolested, except occasionally by bands of Indians passing from one lake or district to another.

Moose are now scarce all along the river, as are deer of all kinds.

The wood buffalo, which formerly roamed around all the upper waters, is now nearly a thing of the past. A few still remain scattered over a wide district. Could some means be devised to protect them for several years they would probably soon multiply and become a source of food supply and revenue to the natives. Mr. McDougall, who has for some years past been gathering information concerning the number of these animals and their locality, has kindly given me the following notes. In the winter of 1887-88 on the head waters of Hay River which flows into Great Slave Lake, and west of Battle River, a tributary of the Peace, the Indians saw three bands containing seventeen, ten, and four, respectively; they killed five, but Mr. McDougall did not ascertain whether these were in addition to the above numbers. The same winter three bands were seen between Salt River and Peace Point on Peace River, numbering fifty, twenty-five, and about twenty-five, respectively. None of these are reported to have been killed. During the winter of 1886-87, between the north end of Birch and the south end of Thickwood Mountains, distant about one day, or thirty miles, from Fort McMurray on Athabasca River, one band of about thirteen was seen. Since then five of this band have been killed. Below Red River, a tributary of the Athabasca, and between

Birch Mountains and Athabasca River, and ranging down to Poplar Point on the Athabasca, another band, said to contain about twenty, was seen. Altogether we have only about one hundred and eighty head of wood buffalo in this vast extent of territory. The paucity of their numbers is, to some extent, a protection to them. If they escape epidemics and such a winter as almost exterminated them on the Upper Peace some years ago they may possibly increase. Whenever the Indians come across a band they try to exterminate them, whether they need them for food or not. They try to drive them into a bog, if one be convenient; and, if they succeed in this, their object is soon accomplished, for the poor brutes mire in the bog and are quickly killed. The Indian feels, after accomplishing a feat of this kind, as if he had won a battle, and never thinks of the reduction in his food supply.

Owing to excessive competition in the outer or southern parts of the district, the supply of fur is gradually decreasing, both in quantity and quality, for the Indians now kill anything they see at any time in the year, knowing that if one will not buy from them another will. I have known them to break into a beaver house in the month of June, after barring all means of exit, and kill both old and young, though the young were hardly able to crawl about. When there was only one trading company in the territory such things were not only discouraged but punished, by declining to buy out of season, and refusing to give credit to the Indian guilty of such unnecessary destruction. In this way fur-bearing animals were protected from extermination. Now, no such check can be applied, and consequently the supply is slowly diminishing, and the only source of food which the Indian possesses, outside of wild fowl and the fish in the lakes and streams, will soon be gone. In fact, it is already gone, to such an extent that he is often starved for the want of means and appliances to hunt or fish with. From this cause many have starved to death in the last two years in the Athabasca district. If the present rate of decrease is maintained in the supply of fur, in a few years it will be but little assistance to the Indian as a means of living. Then he will, as far as possible, remove to the vicinity of the settlements, where the public will have to sustain him, and the only business now pursued in the northern part of the territory will almost cease. The evil will, to a certain extent, work its own cure; for the stoppage of the trade will allow the fur-bearing animals to increase until it pays white trappers to engage in hunting: once the Indian becomes assured of a living elsewhere he will resort to the hunting field no more.

I would respectfully suggest that some method be devised for restricting the indiscriminate slaughter of fur-bearing animals. For the greater part of this slaughter there is no reasonable excuse, as most of the fur-bearing animals are useless as food, or are never eaten (which is the same thing), and protecting them during the breeding season would entail no hardship on anyone. To appoint and pay protective officers would probably cost more than the whole business is worth to the country, and the result would likely be a failure. An alternative would be to lease the country to companies in districts large enough, and for terms long enough to make it an object to them to protect the trade and preserve the fur from extermination. The lessees should also enter into bonds not to accept a skin out of season, or one too young, under a heavy penalty for breach of this condition. It would probably be difficult to prove any such breach, but the fear of the penalty and the profit from protecting the trade would, I believe, accomplish all that is desired.

It is true that such an arrangement as a monopoly seems contrary to the spirit of the times, but the alternative is serious. Objection to such an arrangement on the ground of monopoly has less force when we consider that all the competition is now between one large company and a host of individuals, who, as far as known, make little or nothing out of the trade, and would be much better off on farms or in some other occupation in the settled districts.

I disclaim any desire to interfere with the private business of others, but I respectfully submit these facts and views for consideration, feeling that it is my duty, though an unpleasant one, to offer these suggestions.

MINERALS.

Coal.

On the Mackenzie, the first coal I heard of was a seam of which Mr. McDougall at Chipewyan told me, and which is situated at the base of the mountain just above Rapid Sans Sault, on the east side of the river. He could not give me any details concerning its extent, more than that he believed it to be about four or five feet thick, and that it was in the limestone rock of the mountain. If this is true, it indicates that this coal is older than the lignite coal of the country, and probably much harder and better. I did not know of its existence until I got to Fort Chipewyan, or I would have tried to have a specimen sent out after me.

About three and a half miles above Fort Norman, on the east bank of the river, two extensive exposures of lignite crop out. The upper one is overlaid by about fifty feet of clay and a few feet of friable sandstone, and is about fifteen feet thick. The other seam is probably forty feet below this; when I was there it was nearly all under water. It is said to be as thick as, if not thicker than, the upper one.

The upper seam has been on fire for over a hundred years, as it was burning when Sir Alexander Mackenzie passed in 1789. The place is locally known as "Le Boucan." The fire extends at present about two miles along the river, not continuously, but at intervals. When I passed it was burning in three or four places. After it has burned a certain distance into the seam the overlying mass of clay falls down and, to some extent, suppresses the fire. This clay is in time baked into a red colored rock, in which are found innumerable impressions of leaves of plants. Some specimens of these I brought home, and handed to Dr. Dawson. Traces of this red rock were noticed on the bank fourteen miles below Fort Norman; but no trace of lignite was seen near it, having probably been all burned.

The burning seam appears to be of poor quality, containing much shale and sand, which is converted by the heat into scoriæ. It did not appear to me that it would be difficult to cut off all the burning places, and thus stop the further advance of the fire, which is destroying what yet may be of use. In order to find whether the combustion could be checked, I took a shovel at one place and soon had all the burning coal, for a short distance, completely cut off, so that the fire ceased for a time at that spot. It is a pity that at least an attempt to put out the fire is not made. Many persons in the district have an idea that it is subterraneous, and that the seat of it cannot be reached. This is a mistake, as at the point mentioned I cleaned the fire off from the face of the seam to its base and found underneath no trace of burning. The lower seam appears to be of better quality, there being no shale or sand mixed with it, as far as I could see. Heavy rain detained us here for two days, and we burned a good deal of lignite from the lower seam, as we could not reach the top of the bank to procure wood, and could find only a log or two of driftwood. The coal burned well in the open air, and threw out a much stronger heat than a wood fire. These seams are visible at frequent intervals along the bank for eight and a-half miles, after which no trace of them appears for seven miles, where there is another small exposure at the water's edge. This seam appears, from the reports of many travellers, to extend up Great Bear River for a considerable distance. No other traces of coal were observed on the river.

While at Fort Good Hope I noticed that many of the outbuildings and fences were painted with a dull red coloring matter, which, on inquiry, I found consisted of the ashes of wood that had lain in the river for some years. It was said poplar trees yielded the best paint, and that logs that had been in the water long enough were known by the dull blue color of the wood. A sample of the ashes I brought home, and handed to Dr. Dawson. It may be that the color is due to the presence of oxide of iron; if so, this would indicate the existence in the water of iron in solution. But where the iron comes from is a mystery, as none of this peculiar wood was seen or heard of on the upper river. The inference is that the iron occurs far down the river, but whether in the soil or in beds on some of the tributary streams, or whether it is iron at all, has yet to be determined.

The Indians report very large deposits of mica on the south side of Great Slave Lake, and have brought small samples of it to Fort Resolution. While there I tried to get a specimen, but none was available. It is described as being very abundant.

No other minerals of economic value were seen or heard of, except bitumen. On the way up the first indication of this was seen on Great Slave Lake, in the form of the bituminous limestone which has already been referred to. Tar springs, as they are called in the vicinity, exist on the lake. I do not know of any of them on Slave River, but they abound on the Athabasca from near the delta for over two hundred miles up; and one is reported only a few miles from Athabasca Landing, less than one hundred miles from Edmonton.

The following extract from a report by Dr. Bell, of the Geological Survey, published in the Geological Survey Report for the year 1883, will show the geological relation and general appearance of this tar:

"That the deposit is of cretaceous age, but rests directly on limestone of the Devonian system. The bedding of the latter undulates gently, while the asphaltic sand lies in thick horizontal layers upon its surface, and in some cases fills fissures in the upper part of the limestone. The asphaltic matter has no doubt resulted from petroleum rising up out of the underlying Devonian rocks, in which evidence of its existence can be detected. In descending Athabasca River it was first observed a few miles above the junction of the Clearwater branch, below which it becomes more conspicuous, forming the whole banks of the stream, with the exception of a few feet of limestone at the base, for a distance of many miles. These banks are sometimes about one hundred and fifty feet in height, and frequently maintain an elevation of about one hundred feet for a considerable distance. Except where they have been long exposed to the weather, they generally look as black as coal. A thick tar is often seen draining out of the deposit, and in numerous places on the ground at the foot of either bank, or on terraces lower than their summits, this tar collects in pools, or flows in sluggish streams to lower levels among the peaty materials in the woods. The surface of these accumulations of tar is usually covered with a hardened pitchy crust. The boatmen on the river break through this crust to collect the underlying tar, which they boil down and use for pitching their craft."

In connection with this formation may be mentioned an escape of natural gas which occurs on the river a short distance below Grand Rapids. It comes out of the bank at the water's edge on the west side of the river. There is such a quantity of it that when ignited it will continue burning until the water rises and extinguishes the flame. The boatmen on the river use it to cook their meals. They say the flame sometimes rises to a height of several feet above the ground. It is said to come out of a narrow crevice which runs at right angles to the course of the river at this point and disappears in the water. The boatmen describe the sides of this crevice as bearing a strong resemblance to the tar-bearing sand seen farther down the river. This sand was first noticed by me in my descent of the river in 1884, about thirty-five miles below Grand Rapids; but according to this statement of the boatmen, it occurs several miles farther up the river.

Tar springs are also reported on Little Slave River, but this I hardly credit, as I have been up and down that river twice, and though I saw the place where they are said to exist I did not notice any tar. A tar spring is known near the mouth of Martin River, on the Lesser Slave Lake, and specimens from it have been taken into Edmonton. I have heard of another tar spring on the Athabasca, near the mouth of the Pembina. There is also one on Tar Island, near Smoky River, twenty-three miles below where the cart trail crosses Peace River; and another some distance below that. These indications lead to the conclusion that all this vast region is underlaid by a deposit of this material. It appears that it is of little or no value in itself, except in so far as it indicates the existence of petroleum. If it shows the presence of petroleum of good quality we have here probably the largest oil-bearing district in the world, comprising nearly 150,000 square miles; and as the indications are said to extend down the Mackenzie below Lake Athabasca, the above area may be only a part of our northern oil district.

It is a pity that a test well has not been sunk in the vicinity of Athabasca Landing to determine the existence there, and the quality of the tar. If illuminating and lubricating oils and paraffin were found in quantity, it would give an impetus to the development of that part of the North-West which nothing else could.

When we consider the nearness of the southern limit of this district to the western coast of the continent (by the present trails and the railroads less than one thousand miles) we see that, in supplying our western country and a part of Asia with these products this district possesses a great advantage. If it were once certain that an outlet could be had by the mouth of the Mackenzie for part of the year, the northern part of this district would, during the four or five months of navigation, have facilities for shipment almost unequalled, as the carriage down the Mackenzie would require very little motive power, only enough to keep the vessels from being beached. If it were found that the sea is not open long enough, or is too uncertain and hazardous, a cargo could be discharged at the foot of McDougall's Pass, and the oil could be pumped over the summit to navigable water on Bell River. True, it would have to be raised over an elevation of twelve hundred feet, involving a pressure on the lower pipes of about three hundred and sixty pounds to the inch; but the cost of the strong pipes required would be counterbalanced by the comparative cheapness of the descent of Mackenzie, Bell, Porcupine and Yukon Rivers, while from the mouth of the latter it is only about three thousand six hundred miles to Japan, as compared with about five thousand from San Francisco.

Mr. G. C. Hoffman, Chemist of the Geological Survey, says the tar or maltha, as at present found on the surface throughout a large district on the lower Athabasca, could be utilized for a bituminous concrete for the paving of roads, courtyards, basements, and warehouses, and for roofing. The tar is found combined with fine, colorless, siliceous sand, which constitutes 81·73 per cent. of the mixture.

Last fall a man named McDonald, living at the mouth of Red River, on the Athabasca, undertook to dig a well at that place, but found all the soil to be so saturated with tar that he could get down only a few inches. He told me he tried several acres of ground before he could find a suitable place to dig for water. It is possible that a well bored at Edmonton would, at a reasonable depth, tap the formation containing this tar, and it is almost certain that one bored at Athabasca Landing would. A great deal might be said of the value of an oil deposit here; but as those interested in the trade fully understand all that, it is needless to do more than mention the localities in which indications are known to exist, and the facilities for getting to them, for the information of those desiring to test the question.

Large deposits of salt are reported on Salt River, some miles from Fort Smith. I did not have an opportunity of visiting them, but they are described as extensive. The salt is used all over the Peace, Athabasca and Mackenzie districts, and to the taste is pure. Mr. McConnell, of the Geological Survey, visited the deposits in the fall of 1887, and no doubt will give a full and comprehensive report of them.

The railroad station nearest to Edmonton is Calgary, on the Canadian Pacific Railway, the distance by the cart trail being about one hundred and ninety-six miles, and air line distance one hundred and seventy-two. All the material brought into Edmonton and also the northern district has to be freighted along this trail, and already the machinery for several steam mills has been hauled over it. The freight rates from Calgary to Edmonton are from one and a-half to three cents per pound, according to the state of the roads and the necessities of the importer.

From Edmonton, by the existing trail, to Athabasca Landing, is a distance of ninety-six miles, the direct distance being about ten miles less. The freight rate between these points is about two cents per pound. The Hudson's Bay Company hauls all the trading outfits for the posts north of Edmonton over this route, and the machinery for three steamboats has passed over it. In 1887 and 1888 there was a portable saw-mill at Athabasca Landing, with which to saw lumber for the construction of the steamer "Athabasca." Had there been a drill there at the time a test well could have been sunk at a very slight cost.

The steamer "Athabasca" runs down the river one hundred and sixty-eight miles to the Grand Rapids. Between this and Fort McMurray there are eighty-three miles of rapids, on which the Hudson's Bay Company has a line of boats capable of carrying about ten tons each. From Fort McMurray there is almost unbroken easy navigation to the Arctic Ocean. The steamer also goes up the Athabasca to Little Slave River, sixty-eight miles from Athabasca Landing, and up the latter stream several miles. From the head of steamboat navigation on Little Slave River it is about sixty miles to Lesser Slave Lake, and about sixty along it to Lesser Slave Lake post; thence seventy-six miles by cart trail to Peace River Landing.

THE NATIVES.

On the Mackenzie I did not stay long enough to learn much about the Indians in the district, nor did I see many of them. While we were in the delta of the river nine large boats loaded with Esquimaux from the coast passed on their way up to Fort McPherson to do their trading for the season. These people come up from the coast in skin boats, made, it is said, of whale skin put around a wood frame. These boats present a very neat appearance, and are capable of carrying about two tons each. Whale oil is one of the articles they bring in for sale. The Esquimaux are reputed to be great thieves, and to require close watching. For this reason they were not encouraged to remain when they called on us. Moreover, as they are not very cleanly in person, their presence is not desirable. They were formerly very aggressive toward the Indians on the lower part of the river, frequently coming up and robbing and sometimes killing them. Many years ago they received a severe chastisement for this from the combined whites and Indians, and since that have been guilty of no very aggressive act, though they are inclined to be overbearing when they have the advantage in numbers. It is said that murders are frequent amongst themselves; and, as in most savage tribes, retribution is the prerogative of the kin of the murdered. Missionaries have tried to do something toward their moral improvement, but hitherto without very much effect. Many of them still hunt with the bow and arrow and spear, as it is not considered wise to trust them with gun and ammunition.

Through the kindness of the Hudson's Bay Company's officers I was furnished with the following census, taken in 1881, of the inhabitants of the vicinity of each post. At some of the posts I learned the number now living there, and in every case, when comparison was made between the census of 1881 and the number now living, it was found that the figures had decreased; but as the latter count was hurried and necessarily imperfect, I will not give the figures, and only mention the fact that they are not increasing. This is also the opinion of all the people in the district to whom I spoke on the subject.

The following table, from the census of 1881, includes, besides the Mackenzie Basin proper, Rampart House, on the Porcupine, and LaPierre's House, on Bell River:—

WHITE POPULATION.

Place.	Men.	Women.	Boys.	Girls.	Total.
Rampart House	2	1	1	2	6
LaPierre's House and Fort McPherson	11	6	12	9	38
Good Hope	8	4	6	8	26
Norman	2	2	1	4	9
Liard, Liard River	7	4	4	5	20
Nelson, do	5	3	5	3	16
Simpson	14	6	9	10	39
Providence	13	14	8	7	42
Rae	8	4	8	6	26
Big Island	5	4	9	8	26
Totals	75	48	63	62	248

INDIANS.

Rampart House	80	68	73	65	286
La Pierre's House	36	41	25	39	141
McPherson	93	87	95	76	351
Good Hope	178	142	132	131	583
Norman	74	76	58	46	254
Liard	46	47	75	48	216
Nelson	44	42	66	57	209
Simpson	130	136	124	110	500
Providence	92	106	142	116	456
Rae	128	147	188	152	615
Esquimaux at McPherson	80	100	80	90	350
Totals	981	992	1,058	930	3,961

The Rev. Father Grouard, Roman Cotholic missionary at Chipewyan, who is well acquainted with all the country around Peace River and the lakes, gave me the following as the approximate numbers of the Indian population at the places mentioned. They are all in the Hudson's Bay Company's District of Athabasca:—

Resolution	300
Fort Smith	200
Chipewyan	500
Fond du Lac	250
Vermilion, Peace River	300
McMurray	150
Total	1,700

I have no means of determining the Indian population in the Peace River district, which includes the Lesser Slave Lake valley; but, from my knowledge, having been there twice, I would not place the number at more than seven or eight hundred all told.

The Indians on the lower Mackenzie not having come much in contact with whites, except the missionaries and the Hudson's Bay Company's officers, have retained more of their primitive simplicity and truthfulness of manner than the Indians on the Peace and Athabasca. The native population on the Mackenzie did not appear to be as much mixed with white blood as that on the Peace and Athabasca; but, as I have not seen as much of the people on this as on the latter two rivers, such may not be the case.

At every point where I came in contact with the natives they were obliging and kind, but like all Indians I have met, they expect to be well paid for it. This, of course, is much better than to have them display no feelings but those of extreme selfishness and still expect all the kindness and attention one can bestow on them.

FROM FORT CHIPEWYAN TO EDMONTON.

As soon as the ice on the river was strong and the snow sufficiently deep I took my departure from Fort Chipewyan for Edmonton. I took three dog teams with me as far as Point Brulé, on Athabasca River, from which place I sent back one of them, the other two going with me to Fort McMurray. I left Fort Chipewyan in the early morning (four o'clock) of the 27th of November, and travelled by way of Quatre Fourches Channel and Lake Mammewa.

On the way across Lake Athabasca to the Quatre Fourches one of the men (Morison) dropped through the ice and had a very narrow escape from drowning. During the journey I made a rough survey of the channels and Lake Mammewa, which will enable me to lay it down on our maps better than has heretofore been done. I arrived at Fort McMurray on the afternoon of the 3rd of December. Here I had a day's rest, both men and dogs having much need of it. I left Fort

McMurray on the morning of the 5th, taking the Hudson's Bay Company's winter trail to White Fish Lake, and having the assistance of two of their dog teams which were going across to the Long Portage.

From White Fish Lake I came south-easterly over an Indian trail, never before travelled by white men, to Heart Lake; thence to Lac la Biche; and thence by horses and sleighs to Victoria, on the Saskatchewan River. From Victoria to Edmonton wheels had to be used. I arrived at Edmonton on the evening of 23rd December, and after transacting some business there I left by waggon for Calgary on the morning of the 25th. I reached Calgary on the morning of the 29th and left on the morning of the 30th, arriving in Winnipeg on the 31st.

On the way from Fort McMurray to Lac la Biche I kept up a survey of my track—rough, it is true; but on plotting it I find that it agrees with the latitudes of the terminal points within three or four miles, though these latitudes are uncertain. This will fill a gap in our maps, as heretofore nothing certain was known of that region.

After spending some days in Toronto in connection with my magnetic work, I arrived in Ottawa on the 15th January, since when I have been busy preparing my maps and returns.

MAGNETIC OBSERVATIONS.

I give the results of the magnetic observations taken during the expedition. The declination was determined with a six-inch needle in a box which could be attached to the dip circle. It was made from the Surveyor-General's design, and suited the purpose very well, saving the trouble of carrying a compass. The total force was determined each time with two weights, thus giving two independent determinations, and the quantity given is the mean of these. Very seldom they differed by more than a unit in the second decimal place. The value is given in British units, but is computed and entered in the record book in both British and C. G. S. units. At Fort Good Hope I had the good fortune to meet an old French Canadian who went down the river in the spring of 1844 with Captain Lefroy (now General Sir J. H. Lefroy), when he went to that place to determine the magnetic elements. He showed me the post which Captain Lefroy had set up to observe on, and I placed my tripod over it. That was the only place at which Captain Lefroy observed where his position and mine were exactly the same.

While determining the declination at the Boundary Observatory on the Lewes River I took simultaneous readings of the needle and the declinometer, with which readings of the declination were taken twice daily during my stay there. This will afford a very close determination of the declination at this point. As most of the results are deduced from but one observation, their value is doubtful, especially in the case of the declination. The latitudes and longitudes given in my magnetic record on the Lewes and Pelly are deduced from the survey, and are correct to within a very few seconds of arc. Those between the Pelly and Mackenzie are only approximate; and those on the Mackenzie are those given by Captain Lefroy in his "Diary of a Magnetic Survey of a portion of the Dominion of Canada, executed in the years 1842–1844." At one or two of the points I was unable to determine the declination, not being able, on account of clouds, to find the true astronomical azimuth of a reference object.

Place.	Date.	Latitude.	Longitude.	Declination.	Dip.	Total Force.
	1887.	° ′	° ′	° ′	° ′	
Lake Lyndeman	June 25..	59 47·1	135 04·8	32 16·8	77 05·1	12·969
Marsh Lake	July 17..	60 21·1	134 17·2	32 46·1	77 32·5	13·076
Cañon	do 24..	60 42·3	135 04·1	30 55·2	77 43·9	12·884
Lewes River	Aug. 7..	62 04·5	136 04·0	33 54·8	78 16·4	13·068
Fort Selkirk	do 18..	62 47·6	137 24·9	34 17·0	79 08·6	13·049
White River	do 26..	63 11·9	139 37·8	34 27·9	78 19·4	12·950
Stewart River	do 27..	63 22·3	139 28·5	33 52·8	78 36·6	12·933
Forty-Mile River	Sept. 12..	64 25·5	140 31·7	35 01·1	78 46·2	12·885
	1888.					
Boundary	Jan. 3..	64 41·0	140 54·0	Not read.	78 49·9	13·002
do	Feb 27..	64 41·0	140 54·0	35 45·3	78 49·4	13·012
do	do 28..	64 41·0	140 54·0	35 47·5	78 49·4	13·018
Porcupine River	May 16..	65 43·0	139 40·0	37 44·3	79 57·3	13·053
do	do 20..	65 43·0	139 40·0	37 23·7	79 52·4	12·962
La Pierre's House	June 7..	67 23·0	Unknown.	Not read.	81 24·7	12·998
McPherson	do 22..	67 26·0	134 57·0	46 00·8	81 48·9	13·205
Good Hope	July 13..	66 16·0	128 31·0	41 30·9	82 18·4	13·264
Norman	do 29..	64 54·3	125 43·1	33 39·0	82 00·5	13·350
Mackenzie River	Aug. 5..	64 26·7	125 03·3	41 34·6	81 56·1	13·360
Simpson	do 27..	61 52·0	121 25·2	37 42·3	81 19·2	13·501
Resolution	Sept. 20..	61 10·5	113 46·5	38 19·9	82 09·1	13·680
Chipewyan	Nov. 22..	58 43·0	111 18·7	27 15·3	81 21·8	13·708
do	do 23..	58 43·0	111 18·7	27 09·5	81 22·5	13·729
do	do 24..	58 43·0	111 18·7	27 17·9	Not observed.	

In 1843 and 1844 Captain Lefroy observed at Forts Chipewyan, Resolution, Norman, and Good Hope. At Chipewyan his observations extended throughout the winter. His values there are: declination 28° 45′.8,; dip, 81° 36′.8; force, 13·885. At Resolution his declination was 37° 12′.5; dip, 82° 44′.4; force, 13,956. At Simpson: declination, 38° 00′.4; dip, 81° 52′.2; force, 13·808. At Fort Norman: declination not observed; dip, 82° 34.3; force, 13·653. When he was there, Fort Norman was up the river from its present site, about midway between the place of my observations of 29th July and 5th August. At Fort Good Hope: declination not observed; dip, 82° 55′.9; force 13·681. At Fort Simpson Sir J. H. Lefroy's observations extended from 26th March until 25th May. The bi-daily readings of my declinometer at the Boundary for the months of November, December, January and February are appended, and will serve to show the fluctuations in, and the limit of the range of, the declination.

METEOROLOGICAL OBSERVATIONS.

In my meteorological observations, which are given in the appended tables, the barometer readings are recorded as read, and the temperature of the attached thermometer is always given, so that the temperature correction can be made at any time. After I left the boundary on Lewes River the barometer readings are those of my aneroid, and the temperatures given with them are the temperatures of the air in which the barometer was exposed. Before leaving the boundary I determined the effect on the aneroid of change of temperature. I give the readings, from which it will be seen that this particular instrument, at least, is pretty well compensated for temperature:

January 18th, 1888, temperature in house, 64° Fah.

Mercurial barometer, corrected for temp., 30·158; aneroid ...	30·215
Outside temperature.—41°·0 Fah.; aneroid	30·120
Range of temperature, 105°; range in aneroid.....	0·095
Correction for each degree of change of temperature.....	00·0009

A second and better trial on the same day resulted thus:

In house, mercurial barometer, corrected for temperature....	30·149
do aneroid do	30·200
Outside, aneroid do	30·121

Inside temperature 68°; outside—31°·5; range 99°·5:

Range in aneroid	0·079
Correction for change in mercurial barometer	0·003
Corrected range in aneroid barometer	0·076
Correction for each degree of change in temperature	0·000763

This, so far as ordinary changes of temperature are concerned, is less than the probable error of reading the instrument, and may be neglected.

Before I began to keep the regular daily record I took, whenever I had an opportunity, simultaneous readings of the mercurial and aneroid barometers; and as such readings were taken while I was passing over the summit of the Taiya Pass we have the means of finding the value of the readings of this instrument up to an altitude of 3,400 feet. I give the corrected readings of the mercurial barometer, with no dates, for the sake of brevity, but the readings are entered in order of time:—

	in.	in.	in.	in.	in.	in.	in.
Mercurial	29·149	28·779	28·741	28·334	27·537	26·289	26·235
Aneroid	29·150	28·795	28·750	28·325	27·500	26·295	26·225

These comparisons might be extended, but I think the above are sufficient for the purpose intended, viz., to show the reliability of the aneroid which I used.

In the column headed "water change," the figures show the rise or fall in inches, the arrow denoting whether the water is rising or falling. Except on Sunday, the change during the night was alone noted, the average interval being about ten hours. The record for the last twelve days of October was given me by the Ven. Archdeacon Reeve, of Chipewyan, who, during his stay at that place, kept a daily meteorological record for the head office at Toronto.

No regular record of the appearance and brilliancy of the aurora was kept during my stay at the boundary. Nothing unusual was noticed in this connection, except its appearance two or three times in daylight. The first time I saw this phenomenon my attention was drawn to a long, thin, streamer-like cloud: as the air was perfectly calm, it excited my curiosity and I watched it closely, noticing all the fluctuations in intensity, sudden increase and decrease in extent, and quickly shifting movement of the aurora. It was noticed again on two or three occasions and observed closely, to determine whether or not it was aurora, but always with the same result. It could have been nothing else. It was of about the brilliancy of pale aurora when seen at night, although the sun at the time was well above the horizon. Several members of the party observed all these appearances as well as myself. This phenomenon has been seen by several others. (See Encyclopædia Britannica, Vol. III, pages 90–91.)

As to the aurora making an audible sound, although I often listened when there was a very brilliant display, and despite the profound stillness which is favorable to hearing the sound, if any sound occurs, I cannot say that I ever even fancied I heard anything. I have often met people who said they could hear a slight rustling sound whenever the aurora made a sudden rush. One man, a member of my party in 1882, was so positive of this that, on the 18th November, when there was an unusually brilliant and extensive display, I took him beyond all noise of the camp, blindfolded him, and told him to let me know when he heard anything, while I watched the play of the streamers. At nearly every brilliant rush of the aurora light he exclaimed: "Don't you hear it." All the time I was unconscious of any sensation of sound.

A phenomenon which I never saw elsewhere or heard of was observed twice in the month of February, first on the 19th and again on the 29th. This was green clouds. The display on the 19th was extensive and very beautiful; that on the 29th not so much so. This phenomenon was seen in the morning, just before sunrise, and on both occasions the sun was covered with downy, white clouds, while there

was a very slight fall of minute ice crystals, accompanied by a much higher temperature than usual. The color was a brilliant emerald green, fringed on the lower side with yellow, which, as the sun gradually rose, encroached on the green, until the clouds were all yellow. This color changed to orange and red after the sun had risen above the horizon. The first time the green color lasted about a quarter of an hour; the second only a few minutes. It is probable that the form of the snow crystals in the air produced abnormal refraction and made the green rays of the spectrum conspicuous.

Some of the miners who had been in the country during the winter of 1886–87 told me of the fall of a very large ærolite. None of them had made any note of the date, but all agreed it was two or three days before Christmas, 1886, about the hour of ten in the evening. The flash of light from it was described as very brilliant, making the interior of their ill-lighted huts as bright as mid-day. The report which followed its striking the earth was spoken of as terrific, and this was followed by a rumbling, crashing sound, as of rocks falling, which continued for some seconds after the report. I received accounts of this occurrence from two points, twenty-two miles apart. At these places the impression made was about equally intense. This will give an idea of its size, as well as of the distance away at which it must have struck, as at both places it appeared in the same direction. On the 17th of February, 1887, I was on my way from Forty Mile River to my winter quarters, and accompanying me was a miner who had witnessed the flash and heard the report of the ærolite. About nine miles above my destination we stopped and had some lunch. Just as we were starting again a tremendous explosion was heard, followed by a rending, crashing sound, as though the side had been torn out of a mountain and had fallen from a great height. The explosion appeared to shake the ice on which I was standing, and so near did it seem that I thought, if it were not for the snow that was falling thickly at the time, that the catastrophe would be seen on the mountain side, only a mile or so away.

The miner, who was at the time engaged in arranging the harness on his dogs, instantly exclaimed: "That's one of them things." The direction the sound came from was about north-east. On my arrival at camp I found three miners there who had come up from Belle Isle, and they, too, heard the report and the rending and crashing of rocks. It appeared to them quite as loud as it did to us, and the direction from which the sound came was north-east. At the time we were over fifteen miles apart; hence the source of the sound must have been a very long distance from both points. The time at which the explosion was heard was 1h. 10m. p.m., local time.

It would be ungrateful in me to close this report without acknowledging the kindness and attention of all with whom I came in contact on my travels. On the coast, the United States officers showed me personally every possible attention and kindness, and did all in their power to assist me in difficulties. In the interior the miners were not less attentive and thoughtful, and the traders, Messrs. Harper & McQuestion, were more than kind, giving me much valuable advice, often when it was against their own pecuniary interest to do so, and aiding me in my dealings with the natives to the best of their power. To the missionaries, both Protestant and Roman Catholic, on the Mackenzie River, I owe much for their hospitality and disinterested advice and assistance. To the officers of the Hudson's Bay Company, both myself personally, and the party generally, owe much for their readiness everywhere to assist us all they could. I can truthfully say that their kindness and assistance were disinterested and genuine, if aiding me often without being asked, and certainly with no pecuniary profit to themselves or the Company, is any proof of it.

To the four men who accompanied me through the whole journey I would here return thanks for their cordial co-operation and spirited readiness to do their duty at all times and in all places. They were called on to toil for long hours and under conditions more disagreeable and hazardous than fall to the lot of many; yet they never flinched, even when their lives were in danger. Their names deserve to be recorded here: They are William T. Morison, of Ormstown, Quebec; Charles T.

Gladman, Peterborough, Ontario; F. F. Sparks, Winnipeg, Manitoba; and Frank G. Parker, Waterville, Quebec.

The total result of the expedition has been in round numbers nearly 1,900 miles of accurate instrumental survey, and a very close approximate determination of the position of the International Boundary Line on Pelly-Yukon and Forty Mile Rivers. In addition to this, about eight hundred miles of partially instrumental survey was made, which, when plotted, proves more accurate than I expected. Of this, between five and six hundred miles was over country previously unknown and untravelled by white men. The knowledge gathered by this expedition will enable us to almost complete the map of the extreme north-west portion of our Dominion, as it will serve as a skeleton on which to adjust aright the mass of disjointed information we already possess.

I have the honor to be, Sir, Your obedient servant,

WILLIAM OGILVIE,

Dominion Land Surveyor

DECLINOMETER READINGS—The readings are taken to the nearest tenth of a division. The value of a division in arc is 2′ 1·4″.

Day.	November.		December.		January.		February.	
	7:30 A.M.	1:30 P.M.	7:30 A.M.	1:30 P.M.	7:30 A.M.	1:30 P.M.	7:30 A.M.	1:30 P.M.
1	285·0	266·0	(269·0)	(268·0)	268·0	264·0	269·0	265·5
2	280·0	268·0	(270·0)	(270·0)	273·0	265·0	273·5	263·0
3	282·0	272·5	276·0	268·0	272·0	269·0	280·0	263·0
4	282·0	271·2	273·5	269·0	273·8	270·0	274·2	260·0
5	285·2	303·5	274·5	267·5	274·5	271·6	275·0	268·0
6	317·8	327·0	274·0	262·0	274·0	272·5	272·0	270·0
7	321·0	314·2	274·0	267·0	282·0	269·0	270·5	270·0
8	312·0	304·0	268·0	267·5	273·5	273·0	275·5	260·0
9	286·2	289·0	270·0	268·0	275·3	272·5	279·0	270·5
10	299·0	294·0	271·0	268·5	275·0	270·0	280·5	269·0
11	284·0	287·0	270·0	269·0	276·0	265·0	279·0	272·0
12	280·0	281·0	270·0	264·0	273·5	269·5	280·0	270·0
13	278·9	271·5	265·5	259·0	275·0	269·0	272·0	268·0
14	277·5	271·5	268·2	264·0	288·0	265·0	271·2	266·0
15	278·0	271·0	272·0	264·0	278·0	270·0	272·0	268·0
16	278·0	273·0	260·0	257·0	273·0	270·0	301·0	266·0
17	280·2	267·0	314·0	259·5	271·5	270·0	288·0	276·0
18	284·0	270·0	271·0	260·0	272·0	268·0	278·0	249·0
19	280·5	274·0	270·0	264·0	270·0	265·5	281·0	267·0
20	267·0	251·5	276·0	265·0	272·0	269·0	282·0	264·0
21	331·0	269·0	272·5	266·0	276·0	262·0	276·0	267·0
22	296·0	270·5	273·0	269·0	274·0	265·0	284·0	262·0
23	274·0	271·0	272·0	267·0	291·0	263·0	274·5	266·0
24	(269·0)	(260·0)	269·0	264·0	287·0	266·0	279·0	267·0
25	(271·0)	(269·0)	272·2	269·0	280·0	265·5	275·0	270·0
26	(273·0)	(272·0)	276·0	268·0	282·0	268·0	278·5	268·5
27	(274·0)	(272·0)	290·0	268·0	270·6	259·5	276·0	270·0
28	(273·0)	(272·0)	278·0	266·0	275·0	262·9	282·0	267·0
29	(273·0)	(272·0)	269·0	262·0	272·0	262·0	280·2	269·0
30	(268·0)	(268·0)	273·5	259·5	270·0	268·0		
31	.....	.....	270·0	262·0	278·0	258·0		

NOTE.—During the last days of November and the first part of December, the fibres suspending the magnet had stretched so much that the bottom of the mirror attached to it touched the bottom of the box, and it could not move freely. These defective readings are put in brackets. As the north end of the magnet moved to the east the reading increased, and *vice versa*.

Meteorological Record for the Month of August, 1887.

Day.	Min. Temperature.	Barometer.	Attached Thermometer.	Remarks.	Day.	Min. Temperature.	Barometer.	Attached Thermometer.	Remarks.
	°	in.	°			°	in.	°	
1	23·7	27·691	52·5		18	38·0	28·417	57·0	
2	42·0	27·856	50·0		19	44·0	Out of Order.		
3	21·6	27·936	53·5		20	45·3	do		
4	49·0	27·913	55·0		21	39·0	do		
5	32·5	28·054	42·5		22	47·0	28·763	52·0	
6	42·0	28·152	51·0		23	32·3	.....	.....	
7	31·0	28·230	60·0		24	41·2	.....	.....	
8	53·7	27·830	57·0		25	40·5	28·531	57·0	
9	38·8	28·142	44·0		26	46·0	28·434	48·0	
10	32·7	28·286	58·5		27	43·6	28·403	46·0	
11	42·0	28·393	48·5		28	31·3	28·493	44·0	
12	44·0	28·434	52·0		29	33·0	28·387	40·0	
13	41·8	28·440	56·0		30	43·8	.....	.....	
14	38·7	28·468	56·0		31	44·5	.....	.....	
15	43·2	28·366	50·0						
16	42·0	28·417	50·0						
17	48·0	28·437	55·0		Average	39·9	28·269	51·5	

Note.—This record began 15 miles below Lake Labarge and ended 66 miles below Stewart River.

Meteorological Record for the Month of September, 1887.

Day.	Min. Temperature.	Barometer.	Attached Thermometer.	Remarks.	Day.	Min. Temperature.	Barometer.	Attached Thermometer.	Remarks.
	°	in.	°			°	in.	°	
1	44·7	.....	.....		17	28·0	29·150	31·0	
2	46·0	.....	.....		18	24·0	28·975	38·0	
3	38·8	.....	.....		19	31·4	28·917	41·0	
4	45·0	.....	.....		20	27·6	29·013	31·0	
5	45·3	.....	.....		21	21·6	29·017	24·0	
6	36·0	.....	.....		22	21·5	28·930	23·3	
7	42·5	.....	.....		23	29·6	28·991	32·3	
8	40·5	.....	.....		24	25·7	28·736	31·0	
9	34·0	28·662	55·0		25	24·8	28·826	34·0	
10	37·0	.....	.....		26	26·4	28·528	31·0	
11	40·0	28·857	56·5		27	24·6	28·440	30·0	
12	31·0	28·868	32·0		28	36·3	28·543	39·0	
13	16·0	.....	.....		29	18·8	28·910	24·0	
14	27·0	.....	.....		30	27·3	28·728	30·0	
15	28·0	.....	.....						
16	31·0	28·959	33·0		Average	31·7	28·836	34·2	

Note.—First snow in the valley on 23rd inst. Temperature of river water on 30th inst. = 40°

Meteorological Record for the Month of October, 1887.

Day.	Min. Temperature.	Barometer.	Attached Thermometer.	Remarks.	Day.	Min. Temperature.	Barometer.	Attached Thermometer.	Remarks.
	°	in.	°			°	in.	°	
1	25·0	28·684	28·5		18	31·0	28·498	33·5	
2	23·5	28·827	27·4		19	23·0	28·919	24·0	
3	24·0	28·702	28·0		20	26·0	29·124	28·0	
4	26·2	28·625	29·5		21	19·2	29·364	21·8	
5	21·5	28·981	28·7		22	14·5	29·627	17·2	
6	10·8	28·979	12·0		23	4·5	29·430	9·0	
7	18·6	28·605	23·5		24	4·0	28·978	6·0	
8	29·1	28·745	31·7		25	6·5	28·701	12·0	
9	23·5	29·175	24·0		26	16·5	28·387	23·5	
10	23·1	28·935	28·5		27	13·0	28·527	64·0	
11	25·0	29·097	27·0		28	6·8	28·260	70·0	
12	17·8	29·068	19·0		29	8·8	28·564	68·0	
13	24·1	28·452	27·0		30	4·8	28·913	70·0	
14	23·8	28·529	27·0		31	13·0	28·813	70·0	
15	18·9	28·759	26·0						
16	24·0	28·555	37·5		Average.	18·5	28·813	31·2	
17	24·5	28·389	25·0						

Note.—First ice running in river on 21st inst.

Meteorological Record for the Month of November, 1887.

Day.	Min. Temperature.	Barometer, 7.30 A.M.	Attached Thermometer.	Barometer, 1.30 P.M.	Attached Thermometer.	Day.	Min. Temperature.	Barometer, 7.30 A.M.	Attached Thermometer.	Barometer, 1.30 P.M.	Attached Thermometer.
	°	in.	°	in.	°		°	in.	°	in.	°
1	— 1·5	28·931	67·0	28·933	77·0	17	1·0	28·739	67·5	28·894	68·5
2	— 0·5	29·061	68·0	28·964	71·0	18	— 0·5	29·024	63·0	28·948	66·0
3	16·0	28·300	66·0	.....	.....	19	—12·5	28·820	60·5	28·910	67·0
4	14·5	28·356	61·0	28·415	68·0	20	— 2·0	29·154	59·0	29·189	63·0
5	— 1·0	28·679	65·0	28·672	76·0	21	—12·8	29·047	61·0	29·030	64·0
6	2·8	28·475	64·0	28·520	79·5	22	10·5	28·927	64·0	28·997	53·5
7	—17·5	28·655	66·0	28·650	73·0	23	10·0	29·345	71·5	29·548	75·0
8	— 2·2	28·626	65·0	.....	.....	24	—18·5	29·649	69·0	29·623	68·0
9	— 4·0	28·479	62·5	28·486	71·0	25	—17·0	29·521	68·0	29·471	71·0
10	—20·8	28·711	55·0	28·803	72·0	26	— 5·0	29·288	67·0	29·230	70·0
11	—22·5	29·000	63·5	29·020	71·5	27	— 1·0	29·159	72·5	29·136	64·0
12	—14·0	28·827	61·5	28·850	73·0	28	3·0	29·075	70·0	29·054	60·0
13	—10·5	28·664	61·8	28·692	70·5	29	5·0	29·374	70·5	29·427	68·0
14	—24·1	28·884	59·5	28·952	70·5	30	—16·5	29·524	65·5	29·499	67·0
15	—10·8	28·980	60·0	29·030	68·0						
16	— 0·2	28·926	64·0	28·856	75·0	Average	—5·1	28·940	64·6	28·993	69·5

Note.—Ice set in the river on the 15th inst., at 10 p.m.

Meteorological Record for the Month of December, 1887.

Day.	Minimum Temperature.	1.30 P.M.	Barometer, 7.30 A.M.	Attached Thermometer.	Barometer, 1.30 P.M.	Attached Thermometer.	Day.	Minimum Temperature.	1.30 P.M.	Barometer, 7.30 A.M.	Attached Thermometer.	Barometer, 1.30 P.M.	Attached Thermometer.
	°	°	in.	°	in.	°		°	°	in.	°	in.	°
1	—16·0	.....	29·357	67·0	29·363	73·0	18	—55·1	—42·5	29·624	57·0	29·557	62·0
2	—27·0	—24·0	29·561	62·0	29·603	70·0	19	—23·0	—14·0	29·300	61·5	29·200	68·0
3	—42·5	—38·0	29·680	67·0	.....	.....	20	— 6·0	10·5	28·637	63·0	28·650	64·0
4	—41·0	—36·0	29·503	57·0	29·493	66·0	21	* 3·5	— 6·0	28·849	61·5	29·025	62·5
5	—43·5	—41·0	29·537	59·0	29·544	64·0	22	—27·0	—24·0	29·259	57·0	29·247	66·0
6	—46·3	—42·5	29·331	62·0	29·289	62·0	23	—38·0	—36·5	29·084	52·0	29·204	60·0
7	—48·0	—40·0	29·120	61·0	29·081	61·5	24	—41·1	—21·0	29·339	58·5	29·365	66·5
8	—47·3	—42·5	29·185	57·0	29·259	63·0	25	—26·5	—17·0	29·324	55·0	29·337	68·0
9	—45·5	—28·0	29·267	63·5	29·250	67·0	26	—23·0	—23·0	29·166	63·0	29·224	63·0
10	—30·0	—18·0	28·795	63·0	28·547	67·0	27	—26·0	—27·5	29·633	59·5	29·716	62·0
11	—15·0	—17·5	28·347	57·0	28·399	69·0	28	—41·0	—40·0	29·716	55·0	29·678	64·0
12	—30·5	—32·0	28·834	63·5	29·000	64·0	29	—44·5	—41·5	29·392	55·5	29·326	59·0
13	—53·5	—34·0	29·103	61·0	28·820	61·5	30	—32·1	—10·5	28·903	58·0	28·883	65·0
14	—33·5	—27·0	28·449	59·0	28·430	66·0	31	—10·5	00·0	28·575	55·0	28·556	64·0
15	—28·0	—29·0	28·599	68·0	28·806	71·0							
16	—52·2	—49·0	29·062	60·0	29·119	63·0							
17	—51·0	—37·0	29·173	63·0	29·277	63·0	Ave.	—33·6	—27·6	29·152	60·0	29·141	64·8

* At 7.30 a.m. thermometer read 3·5.

Meteorological Record for the Month of January, 1888.

Day.	Minimum Temperature.	1.30 P.M.	Barometer, 7.30 A.M.	Attached Thermometer.	Barometer, 1.30 P.M.	Attached Thermometer.	Day.	Minimum Temperature.	1.30 P.M.	Barometer, 7.30 A.M.	Attached Thermometer.	Barometer, 1.30 P.M.	Attached Thermometer.
	°	°	in.	°	in.	°		°	°	in.	°	in.	°
1	—10·5	0·0	28·610	57·0	28·764	67·0	18	—51·0	—33·8	30·279	57·0	30·265	67·5
2	—00·7	1·5	29·122	66·0	29·237	70·0	19	—33·8	—22·0	30·071	58·8	30·048	64·2
3	1·5	9·5	29·445	64·0	29·513	75·0	20	—27·0	—20·0	29·784	62·0	29·743	67·2
4	2·0	12·5	29·303	68·0	29·265	76·0	21	—33·3	—32·0	29·694	59·2	29·671	67·0
5	—12·0	0·5	29·291	65·0	29·302	71·0	22	—37·0	—18·5	29·410	59·0	29·440	63·6
6	—19·0	3·2	29·272	66·0	29·289	69·0	23	—32·5	—19·0	29·276	57·5	29·260	67·0
7	4·0	13·0	29·358	68·0	29·333	78·0	24	—46·0	—31·5	29·120	58·8	29·089	64·0
8	1·0	1·0	29·412	67·0	29·432	70·0	25	—36·0	—14·5	28·819	56·0	28·819	65·4
9	— 9·3	3·2	29·184	66·0	29·289	69·0	26	—20·3	—14·5	28·661	57·0	28·597	66·0
10	* 1·0	— 3·0	29·284	66·5	29·120	75·0	27	—36·0	—23·7	28·341	56·0	28·317	60·0
11	—41·0	—41·0	30·014	66·0	30·107	65·0	28	—38·8	—22·5	28·670	52·0	28·689	58·0
12	—41·0	—30·5	30·186	65·0	30·190	68·0	29	—37·8	—37·5	28·937	48·0	29·053	66·0
13	—32·0	— 9·5	29·175	62·5	30·004	70·0	30	—53·0	—40·5	29·091	51·5	29·031	62·0
14	— 9·0	— 2·5	29·777	72·5	29·679	69·0	31	—53·5	—38·5	29·309	52·0	29·459	61·0
15	—22·0	—11·0	29·627	63·0	29·559	68·0							
16	—11·5	— 8·0	29·784	62·5	29·914	68·0							
17	—49·5	—46·5	30·118	58·5	30·198	69·5	Ave.	—25·3	—15·3	29·368	60·9	29·409	67·6

* At 7.30 a.m. thermometer read 1·0.

Meteorological Record for the Month of February, 1888.

Day.	Minimum Temperature.	1:30 P.M.	Barometer, 7:30 A.M.	Attached Thermometer.	Barometer, 1:30 P.M.	Attached Thermometer.	Day.	Minimum Temperature.	1:30 P.M.	Barometer, 7:30 A.M.	Attached Thermometer.	Barometer, 1:30 P.M.	Attached Thermometer.
	°	°	in.	°	in.	°		°	°	in.	°	in.	°
1	—52·7	—39·5	29·757	51·0	29·749	59·0	17	—15·0	— 0·5	28·817	65·0	28·773	66·0
2	—39·5	— 7·5	29·379	55·5	29·415	64·5	18	— 3·8	14·0	28·712	62·0	28·699	74·0
3	—22·5	—16·5	29·539	63·5	29·480	69·0	19	3·8	5·5	28·451	77·0	28·540	74·0
4	—18·5	— 9·7	29·153	54·5	29·039	65·6	20	— 6·5	— 5·0	28·677	64·5	28·856	71·0
5	— 9·8	— 5·5	29·223	54·7	29·290	67·0	21	—10·2	— 5·4	28·709	62·0	28·683	71·0
6	— 6·1	2·5	28·947	60·0	28·896	66·0	22	—16·0	—14·5	28·844	62·0	28·940	69·0
7	1·0	7·0	28·656	61·7	28·774	65·0	23	—21·2	—11·0	29·274	64·0	29·373	72·0
8	2·2	16·0	28·901	59·0	28·956	67·0	24	—35·0	— 4·0	29·200	67·0	29·112	72·0
9	*10·5	—14·0	28·993	67·0	28·996	70·0	25	— 4·0	15·5	29·039	69·0	28·920	73·0
10	— 4·5	— 4·5	28·981	60·5	29·030	71·0	26	— 2·0	3·5	28·777	65·0	28·974	70·0
11	—26·5	—16·8	29·025	59·0	29·050	67·0	27	—11·0	9·3	29·325	64·0	29·364	70·0
12	—39·9	—24·5	29·097	63·0	29·063	72·0	28	—10·0	18·0	29·305	68·0	29·140	73·0
13	—46·8	—31·5	29·352	56·0	29·354	67·0	29	11·2	24·2	29·140	70·0	29·236	74·0
14	—47·0	— 8·0	29·085	57·0	28·983	71·0							
15	—44·5	—24·5	28·795	58·0	28·883	69·0							
16	—24·2	2·5	28·758	61·5	28·805	69·0	Ave.	—16·8	— 4·3	29·031	62·1	29·047	69·2

* At 7:30 a.m. thermometer read 10·5.

Meteorological Record for the Month of March, 1888.

Day.	Min. Temperature.	1:30 P.M.	Barometer, 7:30 A.M.	Temperature.	Barometer, 1:30 P.M.	Temperature.	Barometer, Evening.	Temperature.
	°	°	in.	°	in.	°	in.	°
1	— 2·3	21·2	29·328	65·0	29·240	78·0	.....	.....
2	3·0	23·5	29·197	66·0	29·170	74·0	.....	.....
3	.....	.....	.....	.....	.....	.....	.....	.....
4	.....	.....	.....	.....	.....	.....	.....	.....
5	—10·0	.....	.....	.....	.....	.....	.....	.....
6	.....	.....	.....	.....	.....	.....	.....	.....
7	.....	.....	.....	.....	.....	.....	.....	.....
8	.....	.....	.....	.....	.....	.....	.....	.....
9	—43·0	.....	29·380	40·0	.....	.....	.....	.....
10	—49·7	.....	29·480	25·0	.....	.....	.....	.....
11	—52·7	.....	29·200	28·0	.....	.....	.....	.....
12	—47·0	.....	28·960	30·0	.....	.....	.....	.....
13	—25·0	.....	29·080	40·0	.....	.....	.....	.....
14	—30·7	.....	29·020	30·0	.....	.....	.....	.....
15	—11·0	.....	28·780	40·0	.....	.....	.....	.....
16	— 0·5	.....	28·710	40·0	.....	.....	28·640	10·0
17	— 1·5	.....	28·680	10·0	.....	.....	28·500	14·0
18	—16·0	.....	28·360	16·0	At Noon.	.....	28·300	20·0
19	— 6·7	.....	28·610	00·0	28·480	0·0	28·200	00·0
20	— 3·0	.....	28·220	3·0	27·940	1·0	27·400	20·0
21	6·0	.....	27·300	6·0	27·070	20·0	26·440	15·0
22	—15·7	.....	26·420	—15·7	26·500	26·0	26·500	— 5·0
23	—13·2	.....	26·440	—13·0	.....	.....	26·440	3·0
24	2·0	.....	26·480	2·0	.....	.....	26·640	20·0
25	6·6	.....	26·740	6·0	26·710	30·0	26·640	15·0
26	3·0	.....	26·480	13·0	26·440	30·0	26·540	16·0
27	— 0·7	.....	26·590	6·0	26·660	30·0	26·710	18·0
28	—15·0	.....	26·960	—10·0	26·940	22·0	26·820	20·0
29	17·0	.....	26·800	20·0	.....	.....	27·600	15·0
30	—16·2	.....	27·160	—10·0	27·090	20·0	27·070	25·0
31	22·0	.....	26·940	26·0	26·900	40·0	26·860	25·0

Note.—Barometer temperatures taken from atmosphere in ordinary way.
All readings from the 3rd of March to the 10th of April, inclusive, were taken while on the move from the Yukon to Porcupine River.
Barometer readings taken with an aneroid barometer.

Meteorological Record for the Month of April, 1888.

Day.	Minimum Temperature.	1:30 P.M.	Barometer, 7:30 A.M.	Temperature.	Barometer, 1:30 P.M.	Temperature.	Barometer, Evening.	Temperature.
	°		in.	°	in.	°	in.	°
1	7·0	.....	26·93	12·0	26·98	20·0	27·01	6·0
2	—31·6	.....	26·96	—25·0	.....	.....	27·10	10·0
3	—36·5	.....	26·92	—10·0	.....	.....	26·72	0·0
4	—37·7	.....	26·51	—20·0	.....	.....	26·49	12·0
5	—37·3	.....	26·39	—15·0	.....	.....	26·36	0·0
6	—36·7	.....	26·34	7·0	.....	.....	26·64	0·0
7	—17·0	.....	26·56	—4·0	26·59	11·0	26·66	10·0
8	—12·7	.....	26·86	8·0	26·96	17·0	27·00	10·0
9	—34·0	.....	26·92	—25·0	27·08	20·0	27·10	12·0
10	—28·7	.....	27·06	—15·0	27·38	20·0	.....	.....
11	.....	.....	.....	.....	.....	.....	27·26	10·0
12	—24·0	.....	27·23	—15·0	.....	.....	27·30	4·0
13	—19·8	.....	27·39	—10·0	27·46	30·0	27·47	20·0
14	—24·0	.....	27·55	— 8·0	27·64	20·0	27·71	18·0
15	—13·0	.....	27·82	— 6·0	27·89	26·0	27·93	0·0
16	—17·3	.....	27·94	— 7·0	27·96	20·0	27·93	7·0
17	—26·0	.....	27·78	—10·0	.....	.....	27·68	10·0
18	—24·2	30·5	27·68	— 8·0	.....	.....	27·76	17·0
19	—18·0	31·5	27·68	—10·0	27·69	36·0	27·66	30·0
20	—19·6	18·0	27·63	10·0	27·68	30·0	27·65	20·0
21	— 8·0	7·0	27·73	30·0	27·80	30·0	27·80	30·0
22	—14·2	2·0	27·84	30·0	27·86	34·0	27·84	30·0
23	—30·8	5·0	27·78	20·0	27·74	30·0	27·76	30·0
24	—24·0	22·0	27·76	30·0	27·76	20·0	27·78	34·0
25	—19·5	23·0	27·82	35·0	27·83	30·0	27·84	30·0
26	— 9·5	9·0	27·95	30·0	28·00	32·0	28·00	32·0
27	— 9·0	9·0	27·9[illegible]	30·0	27·95	22·0	27·78	22·0
28	— 7·6	16·0	27[illegible]	20·0	27·66	30·0	27·62	20·0
29	—10·7	37·0	[illegible]	30·0	27·46	36·0	27·48	40·0
30	— 6·0	40·0	[illegible]·02	30·0	27·58	44·0	27·52	38·0

Notes.—Barometer temperatures taken from atmosphere in ordinary way.
All readings from the 12th of April to the 27th of May, inclusive, were taken at a stationary camp at the head of Porcupine River.
Barometer readings taken with an aneroid barometer.

Meteorological Record for the Month of May, 1888.

Day.	Minimum Temperature.	1:30 P.M.	Barometer, 7:30 A.M.	Temperature.	Barometer, 1:30 P.M.	Temperature.	Barometer, Evening.	Temperature.
	°	°	in.	°	in.	°	in.	°
1	19·7	51·2	27·42	30·0	27·35	45·0	27·27	46·0
2	28·0	34·0	27·23	30·0	27·26	40·0	27·30	30·0
3	9·0	.....	27·36	16·0	.....	.....	27·40	30·0
4	6·0	27·5	27·44	20·0	27·49	30·0	27·49	30·0
5	— 1·8	32·0	27·25	20·0	27·18	35·0	27·12	35·0
6	16·8	45·5	27·20	30·0	27·27	40·0	27·31	40·0
7	9·3	46·0	27·33	25·0	27·33	45·0	27·30	40·0
8	17·8	46·0	27·29	30·0	27·28	40·0	27·26	40·0
9	12·7	42·0	27·26	30·0	27·26	44·0	27·26	30·0
10	22·5	43·0	27·30	32·0	27·30	44·0	27·30	40·0
11	18·0	37·0	27·34	30·0	27·35	44·0	27·40	30·0
12	21·5	36·0	27·47	30·0	27·49	40·0	27·46	36·0
13	20·0	39·0	27·45	30·0	27·48	40·0	27·55	36·0
14	21·5	43·0	27·78	36·0	27·83	44·0	27·97	32·0
15	16·3	54·0	28·04	40·0	28·03	50·0	28·00	36·0
16	16·3	52·0	27·90	40·0	27·82	56·0	27·74	36·0
17	17·3	55·0	27·64	30·0	27·68	60·0	27·72	40·0
18	21·0	48·0	27·80	40·0	27·80	50·0	27·77	40·0
19	29·0	35·5	27·70	36·0	27·78	36·0	27·79	25·0
20	15·5	40·0	27·78	32·0	27·75	40·0	27·69	36·0
21	15·0	41·0	27·56	32·0	27·53	40·0	27·46	40·0
22	21·0	44·0	27·52	40·0	27·51	44·0	27·48	30·0
23	23·5	32·0	27·46	33·0	27·48	32·0	27·45	28·0
24	21·0	36·0	27·50	26·0	27·54	38·0	27·49	25·0
25	17·0	39·0	27·47	31·0	27·50	39·0	27·52	30·0
26	31·0	48·0	27·68	44·0	27·67	48·0	27·68	43·0
27	33·0	50·0	27·92	48·0	27·94	50·0	27·92	43·0
28	31·0	54·0	27·97	40·0	28·06	54·0	27·99	41·0
29	29·2	53·0	27·93	35·0	27·90	53·0	28·03	40·0
30	26·2	51·5	27·95	36·0	27·98	56·0	28·28	50·0
31	28·2	43·5	28·41	48·0	28·60	44·0	28·71	41·5

Notes.—Barometer temperatures taken from atmosphere in ordinary way.
Barometer readings taken with an aneroid barometer.

Meteorological Record for the Month of June, 1888.

Day.	Minimum Temperature.	Barometer, A.M.	Temperature	Barometer, 1:30 P.M.	Temperature.	Barometer, Evening.	Temperature.	Temperature, 1:30 P.M.
	°	in.	°	in.	°	in.	°	°
1	29·1	28·82	46·0	28·88	56·0	28·91	40·0	56·0
2	25·5	28·94	42·0	29·00	42·0	29·12	40·0	42·5
3	20·3	29·12	32·0	29·15	46·0	29·14	52 0	52·0
4	17·0	29·20	35 0	29·27	52·0	29·29	37·0	52·0
5	18·3	29·32	32·0	29·31	56·0	29·30	50·0	56·0
6	22·0	29·28	40·0	29·14	58·0	29·07	40·0	60·0
7	32·0	28·87	40·0	28·82	50·0	28·88	49·0	50·0
8	33·0	28·99	40·0	29·00	50·0	28·99	46·0	52·0
9	27·3	29·09	70·0	29·06	52·0	28·99	40·0	52·0
10	25·0	28·90	56·0	28·87	70·0	28·86	70·0	68·0
11	30·6	28·79	40·0	28·80	60·0	28·84	35·0	62·0
12	21·7	28·91	37·0	28·83	45·0	28·87	34·0	48·0
13	22·4	28·88	34·0	28·83	40·0	28·79	31·0	42·0
14	15·6	28·56	40·0	28·56	50·0	28·45	48·0	50·0
15	17·0	28·37	45·0	28·36	50·0	28·40	38·0	50·0
16	25·3	28·42	38·0	28·57	60·0	28·98	30·0	60·0
17	31·0	29·06	58·0	29·06	60·0	29·09	52·0	60·0
18	33·0	29·18	48·0	29·70	62·0	29·81	48·0	62·0
19	32·0	29·94	50·0	29·96	62·0	29·98	52·0	60·0
20	37·3	30·02	50·0	30·02	70·0	30·00	60·0	72·0
21	47·0	30·10	60·0	29·96	74·0	29·86	60·0	74·0
22	48·0	29·86	62·0	29·83	71·0	29·87	50·0	71·0
23	40·0	29·87	60·0	29·88	70·0	29·91	45·0	71·0
24	42·0	29·99	56·0	30·01	70·0	30·08	50·0	54·0
25	43·0	30·12	54·0	30·14	58·0	30·10	53·0	58·0
26	43·0	30·12	60·0	30·01	56·0	29·96	52·0	56·0
27	42·0	29·99	42·0	29·93	50·0	29·86	64·0	56·0
28	42·3	29·85	42·0	29·86	54·0	29·86	48·0	54·0
29	42·0	29·79	55·0	29·84	56·0	29·84	49·0	56·0
30	50·0	29·86	55·0	29·85	58·0	29·84	43·0	58·0

Notes.—Barometer temperatures taken from atmosphere in ordinary way.
Barometer readings taken with an aneroid barometer.

Meteorological Record for the Month of July, 1888.

Day.	Min. Temperature.	1:30 P.M.	Barometer Readings.						Water Ch.
			7:30 A.M.	Temperature.	1:30 P.M.	Temperature.	Evening.	Temperature.	
	°	°	in.	°	in.	°	in.	°	in.
1	34·5	63·0	29·84	60·0	29·80	63·0	29·74	48·5	3·0 †
2	34·0	36·0	29·83	42·0	29·88	36·0	29·90	38·0	7·0 †
3	25·0	54·0	29·95	44·0	29·95	50·0	29·94	47·0	1·6 †
4	38·5	68·0	29·99	46·0	29·98	68·0	29·95	50·0	1·0 †
5	34·2	69·0	30·02	61·0	29·86	69·0	29·99	50·0	1·5 †
6	35·0	70·0	30·00	61·0	30·01	70·0	29·97	51·0	2·2 †
7	48·0	72·0	30·00	56·0	29·96	72·0	29·89	54·0	1·5 †
8	50·8	68·0	29·81	62·0	29·70	68·0	29·65	55·0	1·0 †
9	51·4	68·0	29·58	60·0	29·50	68·0	29·44	55·0	3·4 †
10	48·0	48·0	29·48	52·0	29·52	48·0	29·62	48·0	3·5 †
11	46·0	70·0	29·78	58·0	29·82	70·0	29·82	48·0	6·9 †
12	46·0	68·0	29·80	64·0	29·78	68·0	29·66	52·0	2·3 †
13	42·4	78·0	29·74	60·0	29·76	72·0	29·80	60·0	0·5 †
14	52·0	78·0	29·70	65·0	29·71	72·0	29·72	62·0	1·5 †
15	50·0	68·0	29·80	66·0	29·76	70·0	29·68	52·0	2·7 *
16	43·6	69·0	29·82	60·0	29·68	70·0	29·72	58·0	7·0 *
17	48·5	70·0	29·72	62·0	29·68	70·0	29·61	52·0	2·0 *
18	52·0	61·0	29·69	60·0	29·70	60·0	29·73	60·0	0·7 *
19	48.6	67·0	29·86	63·0	29·89	65·0	29·91	54·0	5·0 *
20	48·0	72·0	30·00	60·0	29·98	70·0	29·96	61·0	36·0 *
21	49·5	76·0	30·04	54·0	30·02	76·0	30·00	60·0	2·1 †
22	52·0	66·0	30·02	.....	30·02	66·0	30·02	58·0	16·0 †
23	50·5	70·0	30·05	60·0	29·98	70·0	29·94	60·0	13·0 †
24	51·7	68·0	29·94	61·0	29·91	68·0	29·86	62·0	6·0 †
25	54·0	62·0	29·82	62·0	29·82	62·0	29·83	55·0	3·0 †
26	46·7	55·0	29·87	54·0	29·87	55·0	29·96	50·0	4·6 †
27	44·0	58·0	30·06	50·0	30·06	58·0	30·07	48·0	1·0 †
28	45·0	51·0	30·06	56·0	29·98	70·0	29·86	58·0	1·0 *
29	44·0	75·0	29·75	65·0	29·62	75·0	29·58	58·0	3·0 †
30	52·0	62·0	29·60	58·0	29·64	62·0	29·68	50·0	5·0 †
31	42·0	45·0	29·70	43·0	29·80	45·0	29·84	45·0	2·0 †

Notes.—Barometer temperatures taken from atmosphere in ordinary way. Total fall 18·2.
Barometer readings taken with an aneroid barometer.
* Rise.
† Fall.

Meteorological Record for the Month of August, 1888.

Day.	Min. Temperature.	1.30 P.M.	Barometer Readings.						Water Ch.
			7.30 A.M.	Temperature.	1.30 P.M.	Temperature.	Evening.	Temperature.	
	°	°	in.	°	in.	°	in.	°	in.
1	33·2	64·0	29·98	48·0	29·98	64·0	29·97	49·0	0·0
2	36·3	68·0	29·97	52·0	29·91	68·0	29·82	48·0	0·5 *
3	34·0	70·0	29·80	58·0	29·66	70·0	29·62	56·0	3·7 †
4	50·0	68·0	29·71	59·0	29·80	68·0	29·87	52·0	2·1 †
5	49·0	76·0	29·90	51·0	29·85	76·0	29·82	55·0	0·6 †
6	39·5	66·0	29·76	52·0	29·71	66·0	29·80	51·0	1·5 *
7	49·0	58·0	29·99	50·0	30·05	58·0	30·00	50·0	1·7 †
8	36·0	60·0	29·95	44·0	29·80	60·0	29·75	50·0	0·6 †
9	47·5	56·0	29·50	50·0	29·54	56.0	29·56	52·0	0·0
10	50·0	52·0	29·78	50·0	29·96	52·0	30·04	55·0	0·0
11	32·7	66·0	30·04	45·0	29·90	66·0	29·86	51·0	0·6 †
12	45·0	66·0	29·86	52·0	29·87	66·0	29·85	55·0	1·1 *
13	50·5	68·0	29·80	54·0	29·77	68·0	29·76	52·0	3·0 †
14	49·5	66·0	29·70	52·0	29·69	66·0	29·68	58·0	2·0 †
15	54·0	68·0	29·66	61·0	29·68	66·0	29.69	52·0	1·0 †
16	45·8	70·0	29·72	52·0	29·58	70·0	29·50	60·0	1·5 †
17	49·6	70·0	29·48	60·0	29·30	70·0	29·23	52·0	0·6 †
18	50·0	72·0	29·20	52·0	29·13	72·0	29·13	60·0	1·1 †
19	48·7	84·0	29·20	56·0	29·22	84·0	29·30	60·0	0·8 †
20	38·2	86·0	29·40	40 0	29·44	86·0	29·30	55·0	2·0 †
21	43·0	66·0	29·34	55·0	29·40	66·0	29·46	50·0	0·8 †
22	36·5	70·0	29·52	40·0	29·48	72·0	29·46	52·0	1·4 †
23	40·0	68·0	29·47	50·0	29·48	68·0	29·48	52·0	0·9 †
24	42·0	70·0	29·42	50·0	29·46	69·0	29·44	60·0	1·0 †
25	46·0	72·0	29·44	60·0	29·47	70·0	29·44	61·0	0·6 †
26	45·0	66·0	29·42	60·0	29·34	65·0	29·35	62·0	1·0 †
27	44·0	55·0	29·36	55·0	29·33	55·0	29·30	50·0	0·5 †
28	46·5	68·0	29·24	48·0	29·30	66·0	29·36	50·0	0·5 †
29	31·8	62·0	29·52	40·0	29·60	62·0	29·59	45·0	0·6 †
30	32·7	68·0	29·57	40·0	29·45	68·0	29·50	52·0	1·0 †
31	37·0	68·0	29·56	52·0	29·56	66·0	29·50	52·0	1·0 †
Average	43·0	67·0	29·62	51·0	29·60	67·0	29·59	53·0	29·0 †

Notes.—Barometer temperatures taken from atmosphere in ordinary way.
Barometer readings taken with an aneroid barometer.

* Rise.
† Fall.

METEOROLOGICAL RECORD for the Month of September, 1888.

Day.	Min. Temperature.	Barometer, 7.30 A.M.	Temperature.	Barometer, 1.30 P.M.	Temperature.	Barometer, Evening.	Temperature.	Water Ch.
	°	in.	°	in.	°	in.	°	in.
1	41·5	29·30	45·0	29·36	68·0	29·40	56·0	0·0
2	46·0	29·53	68·0	29·67	66·0	29·60	50·0	1·0†
3	42·0	29·54	55·0	29·56	68·0	29·46	55·0	0 0
4	47·0	29·23	60·0	29 15	68·5	29·05	56·0	1·0+
5	51·0	29·00	53·0	28·97	67·0	29·04	55·0	0·5+
6	47·6	29·10	48·0	29·14	62·0	29·21	52·0	0·6+
7	51·0	29·25	54·0	29·26	62·0	29·27	50·0	0·5+
8	52·0	29·30	53·0	29·32	61·0	29·32	50·0	0·7+
9	49·0	29·40	52·0	29·42	60·0	29·40	50·0	0·6+
10	48·0	29·52	50·0	29·42	55·0	29·30	50·0	1·0+
11	47·0	29·10	.....	29·01	56·0	28·96	54·0	0·6+
12	47·0	29·00	48·0	29·03	61·0	28·97	52·0	0·7+
13	48·0	29·06	49·0	29·08	64·0	29·11	52·0	0·8+
14	37·7	29·17	42·0	29·20	65·0	29·22	51·0	0·5+
15	44·0	29·16	49·0	29·10	70·0	29·01	56·0	.....
16	56·0	28·98	62·0	28·95	78·0	28·92	55·0	.....
17	51·5	28·79	54·0	28·81	72·0	28·29	62·0	.....
18	52·0	28·87	56·0	29·94	60·0	29·16	50·0	.....
19	37·0	29·28	38·0	29·19	62·0	29·05	55·0	.....
20	44·0	28·88	50·0	28 87	66·0	28·87	56·0	.....
21	51·0	28·91	52·0	28·94	62·0	29·02	50·0	.....
22	38·0	29·10	42·0	29·25	58·0	29·31	45·0	.....
23	35·0	29·35	40·0	29·50	48·0	29·65	46·0	.....
24	33·3	29·59	33·3	.....	.....	29·31	50·0	0·7+
25	42·5	29·42	44·0	29·61	48·0	29·60	44·0	0·5+
26	30·8	29·62	40·0	29·63	54·0	29·60	40·0	0·8+
27	29·2	29·54	40·0	29·61	52·0	29·66	40·0	0·5+
28	35·0	29·76	44·0	29·66	50·0	29·61	46·0	.....
29	40·0	29·16	43·0	28·96	54·0	28·90	50·0	.....
30	37·0	29·28	40·0	29·46	52·0	29·45	37·0	.....
Average	43·7	29·24	46·8	29·28	61·0	29·22	50·5	11·0+

NOTES.—Barometer temperatures taken from atmosphere in ordinary way.
September 16th, temperature of lake water, 53·5°.
September 30th, temperature of lake water, 48·2°.
Barometer readings taken with aneroid barometer.
† Fall.

Meteorological Record for the Month of October, 1888.

Day.	Min. Temperature.	Barometer, 7.30 A.M.	Temperature.	Barometer, 1.30 P.M.	Temperature.	Barometer, Evening.	Temperature.	Water Ch.
	°	in.	°	in.	°	in.	°	in.
1	37·0	29·23	42·0	28·99	54·0	28·98	41·0	.....
2	38·0	29·00	38·0	29·20	56·0	29·22	45·0	.....
3	37·5	29·18	40·0	29·17	52·0	29·15	45·0	.....
4	43·0	29·16	45·0	29·14	50·0	29·00	40·0	.....
5	36·3	28·97	40·0	29·00	56·0	29·02	50·0	.....
6	39·0	29·00	42·0	28·95	62·0	28·90	50·0	.....
7	41·0	28·88	60·0	28·84	64·0	28·82	47·0	.....
8	40·0	28·88	43·0	.....	.....	29·00	45·0	2·0+
9	39·0	29·06	44·0	29·09	42·0	29·18	40·0	.....
10	33·0	29·24	40·0	29·26	40·0	29·34	37·0	0·5+
11	33·0	29·34	38·0	29·42	38·0	29·37	36·0	0·2+
12	32·3	29·36	33·0	29·37	39·0	29·34	34·0	.....
13	31·6	29.29	33·0	29·28	45·0	29·26	38·0	.....
14	32·0	29·24	34·0	29·22	35·0	29·34	39·0	.....
15	23·0	29·44	26·0	29·52	34·0	29·50	30·0	.....
16	26·5	29·51	28·0	29·41	35·0	29·26	51·0	.....
17	27·0	29·16	28·0	29·16	33·0	29·20	30·0	.....
18	27·0	29·36	27·0	29·42	32·0	29·42	30·0	.....
19	25·0	29·14	26·0	29·06	34·0	28·98	30·0	.....
20	31·5	28·88	32·0					
21	20·8	29·020	47·0	28·996	36·0	29·024	34·0	.....
22	27·0	28·882	58·0	28·992	39·0	28·880	37·0	.....
23	24·6	28·796	51·0	28·846	41·0	28·848	27·0	.....
24	30·8	28·838	52·0	28·828	32·0	28·858	33·0	.....
25	27·0	28·768	51·0	28·866	30·0	28·828	33·0	.....
26	27·0	28·914	51·0	28·812	35·0	28·842	35·0	.....
27	36·0	29·170	51·0	29·056	37·0	29·192	27·0	.....
28	31·0	28·760	53·0	29·144	31·5	28·982	33·0	.....
29	24·5	29·206	57·0	29·064	31·0	29·194	32·0	.....
30	30·0	28·950	51·0	29·126	33·0	29·021	32·0	.....
31	28·9	29·108	50·0	29·074	31·0	29·182	30·0	.....
Average	31·6	29·088	42·0	29·032	31·0	28·954	31·0	.....
				29·111	40·4	29·099	36·7	2·7+

Notes.—Barometer temperatures taken from atmosphere in ordinary way.
Temperature of river water on the 7th inst., 51°; on the 4th, 43°; and on the 17th, 38°.
All below the line were got from Rev. Mr. Reeve at Chipewyan.
Barometer readings taken with an aneroid barometer.

ERRATA.

On page 12, fourth paragraph, fourth line, for "nor a star again" read "nor the sun again."

On page 99, last line, for "the sun was covered" read "the sky was covered."